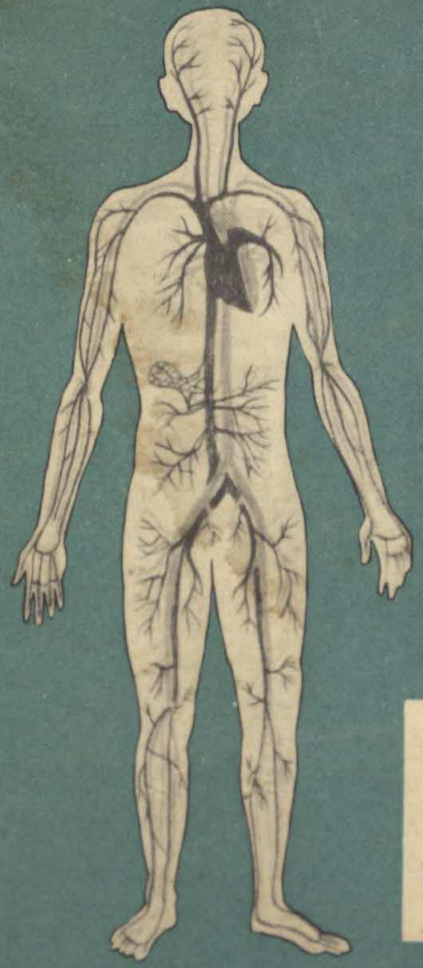
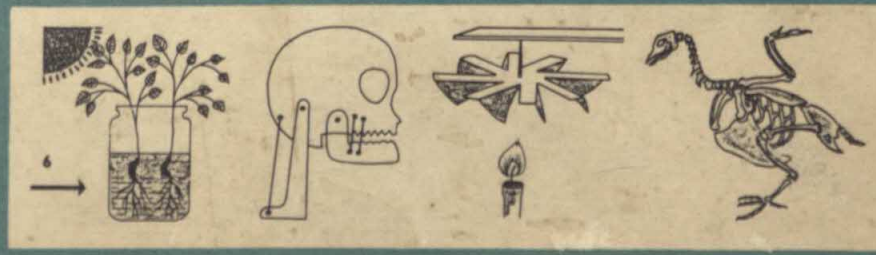
Life and Living 3

B. H. G. CHAPLIN





For pupils in Tropical Pre-secondary Schools — A Practical and Pictorial Course in Nature Study

Notes to Pupils

This book has been written to help you see properly and understand the very wonderful world around us.

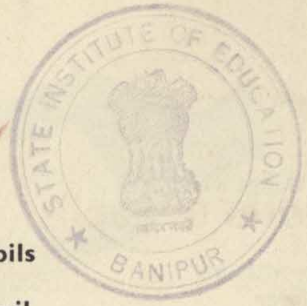
It is a 'doing' book, full of experiments for you to do, things to make and things to collect.

Your teacher will explain all these things to you, but you will have to make sure that, whatever happens, you bring all the things you need to school, so that everybody can get the greatest pleasure out of the lessons.

None of the drawings or pictures in this book are for you to copy. They are there to help you to understand and draw things you really see for yourself. They are *not* to be *copied* into your exercise books at all.

Illustrations by Valerie Herbst

Life and Living 3



CONTENTS

LONGMANS

WATER AND SOIL

Soil and Rocks

1. Pour some ordinary soil into a glass jar of water and leave it for half an hour.

While it is settling look at A, B, and C. They show three things which help to break up the large rocks. Write down what these things are.

2. Now look at the jar where the water has settled. Draw what has happened and try and label it with words that describe each layer.

3. Pour the water off gently. Where does the fine soil go? Does this happen outside when it rains?

4 and 5. Are the remaining pieces rounded, or have they sharp edges, or are they a mixture of the two?

Write down the answers to all these questions in sentences.

6. Put some sharp pieces of hard stone with some pieces of soft stone or broken chalk. Shake them up for five to ten minutes in a tin.

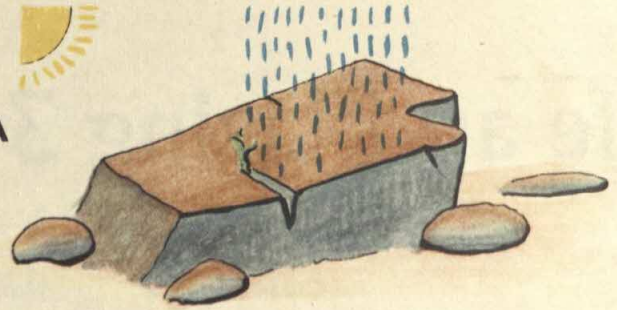
7. Empty the tin on to a piece of paper. What has happened to the soft pieces? Draw the shape of some of the soft pieces before and after shaking.

8. Empty the pieces into a jar of water and allow to settle. Where has the fine sand or chalk come from?

Try to write a simple description of what you have done.

Your teacher will try and arrange for you to see a road cutting. Draw what you see and label what you think is the richest part of the soil and what you think is the poorest part.

A



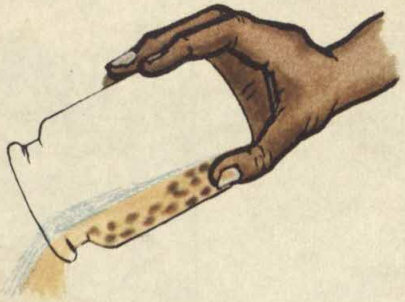
B

C

1

2

3



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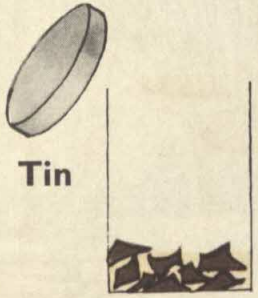

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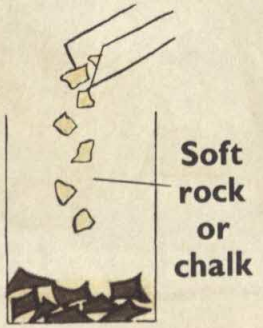
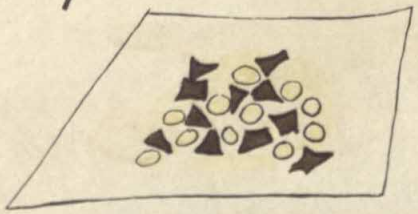


Road cutting

7



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WATER AND SOIL

The River

You may not know a river like this one, but even if you are not near one you can notice the little streams that form as soon as it rains hard.

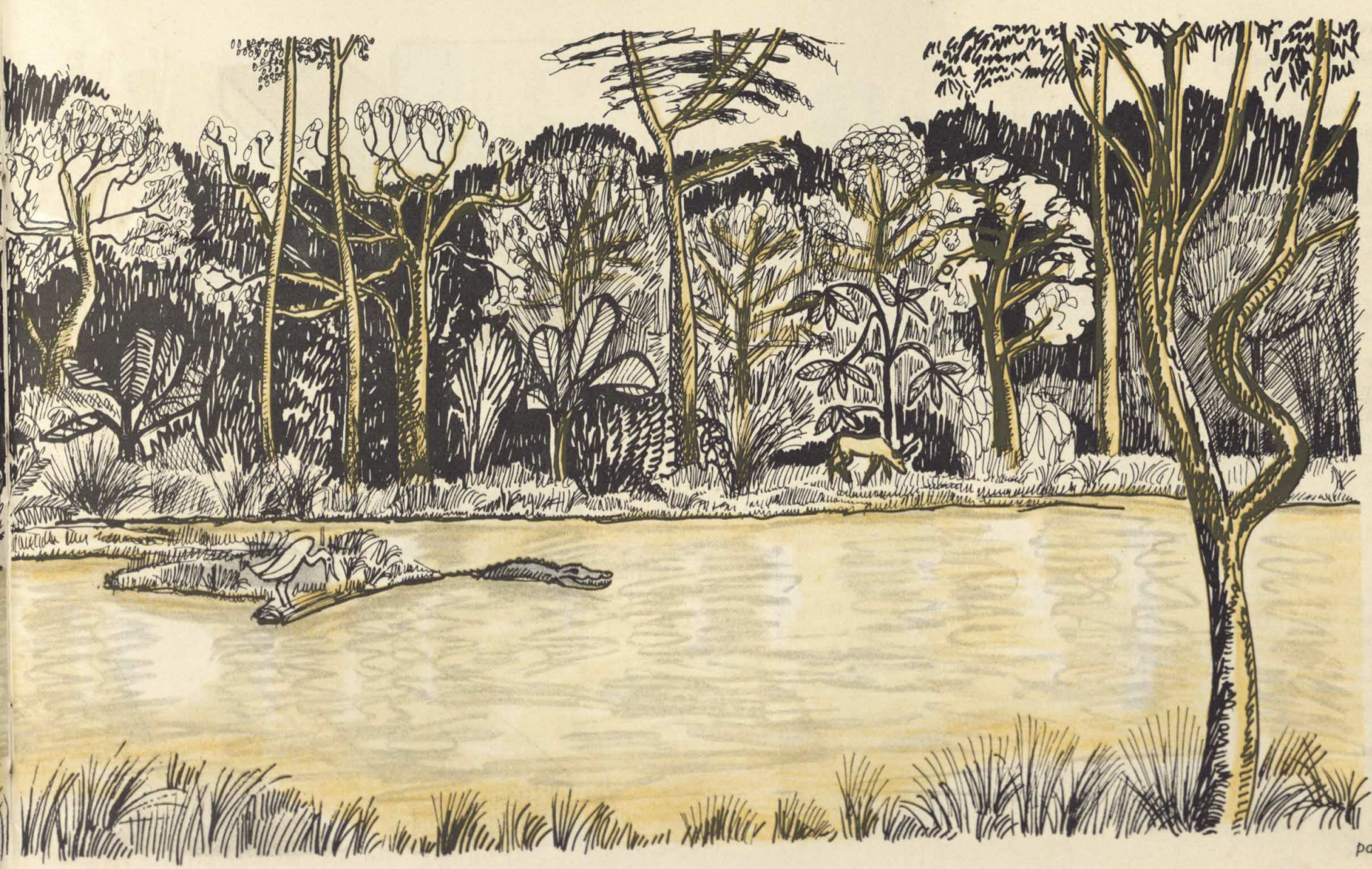
What makes the water in such streams always flow along the same way? Where does it go to?

Write sentences answering these questions.

Rivers are not the same width all the way along. Where is a river widest? At the beginning or the end?

The little picture shows the beginning of the river in the big picture. Write down all the differences you can see between them.

In what ways are rivers important to us? Write down a list of these ways.



WATER AND SOIL

The River and Soil

You will need one or more of the trays you were shown how to make in Book 2. Each group in the class will use one tray.

1. Make a straight river valley using ordinary soil.

2, 3, and 4. Try the effect of 'rain' at different slopes. Use the same amount of 'rain' each time. Make drawings to show any differences in the effect of different slopes. Which loses the most soil?

5. Make a river valley using rich soil on top and gravel or coarse sand underneath. Place a large stone so that the river has to go round it.

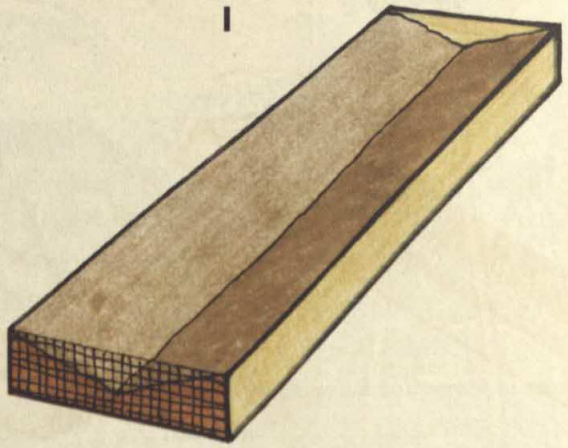
Draw what happens now after it has 'rained' for some time.

6. Try the effect of a barrier of leaves, twigs and grass and, 7, try making the valley a winding one. Use the same amount of 'rain' on each one and draw the results. Make a little note by each drawing to say what has happened. Your teacher may help you in writing this.

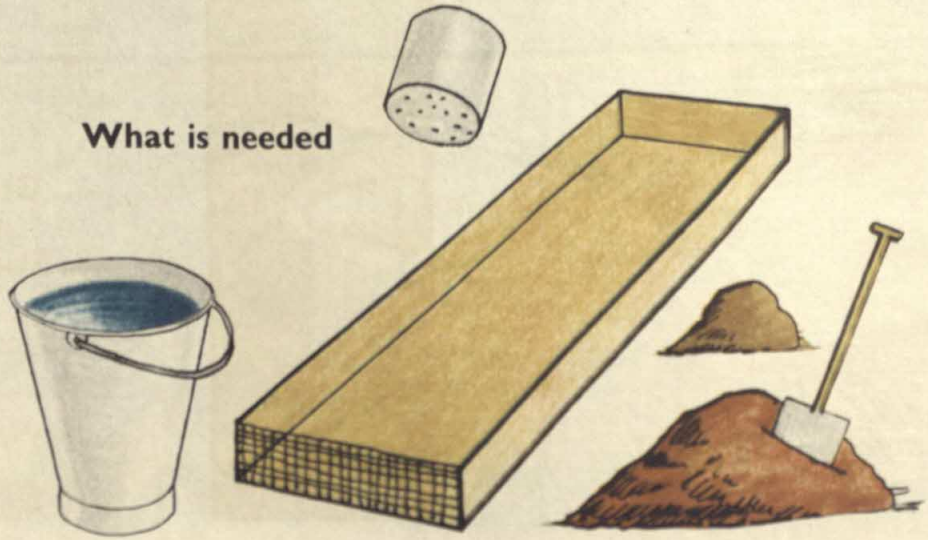
When water moves slowly what kind of soil can it take away?

When water moves fast what kind of soil can it carry away?

When fast-moving water, carrying soil, meets something that makes it go slower, what happens? Do your experiments again if necessary to find the answers to these questions. When you have found the answers write them down.



What is needed



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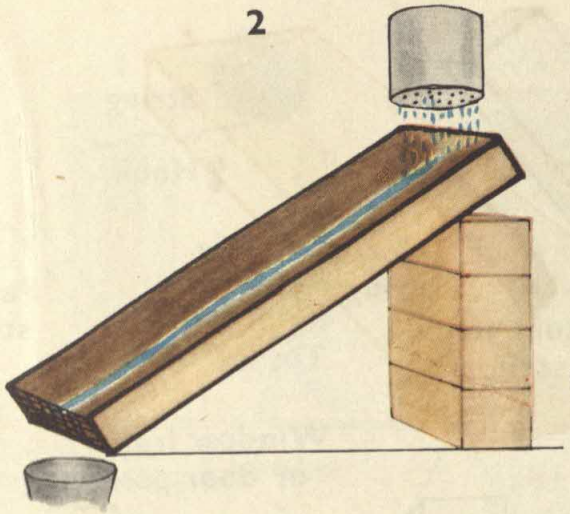

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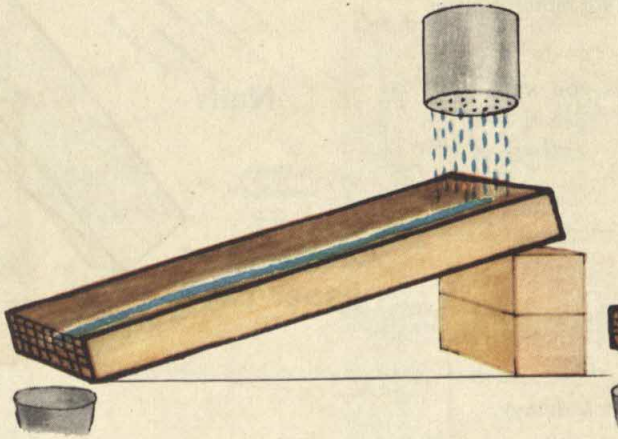

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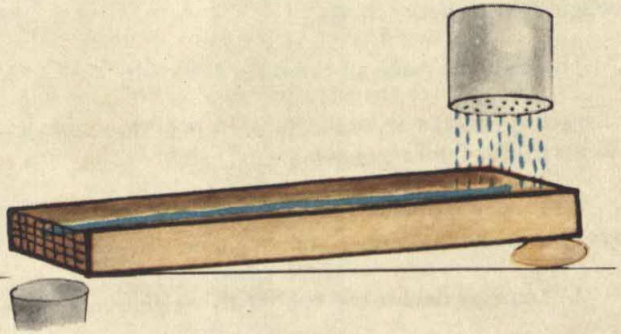
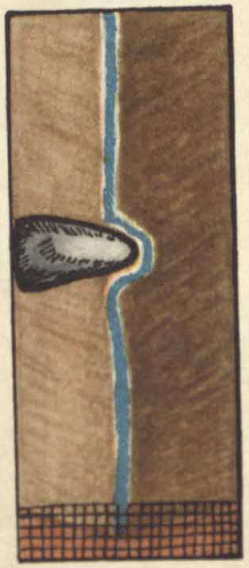


Stone



5

Grass and Sticks

6

Make the valley like this

7

SIMPLE WEIGHING MACHINES

The main part of these machines is a piece of rubber from either a motor or bicycle inner tube or an elastic band.

Use different strengths of rubber bands according as you want to weigh light or heavy things.

The class can make all the different kinds.

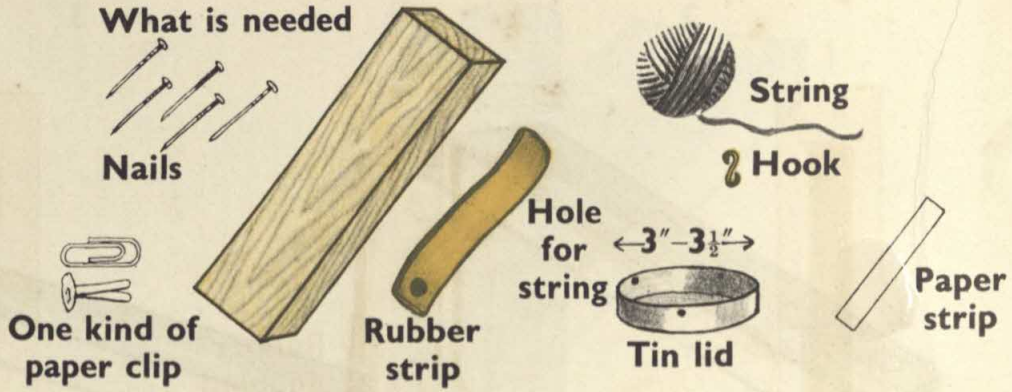
Each group can make a different kind. They will be most useful and necessary for future experiments.

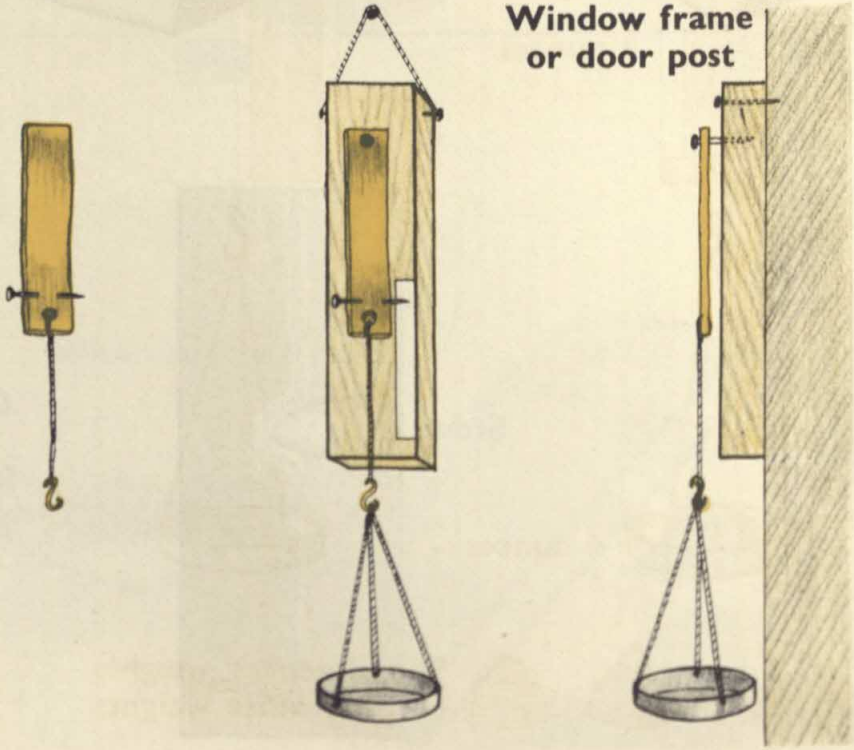
1 shows you how to use borrowed weights (*from a shop or post office*) to make the proper weight marks on your scale.

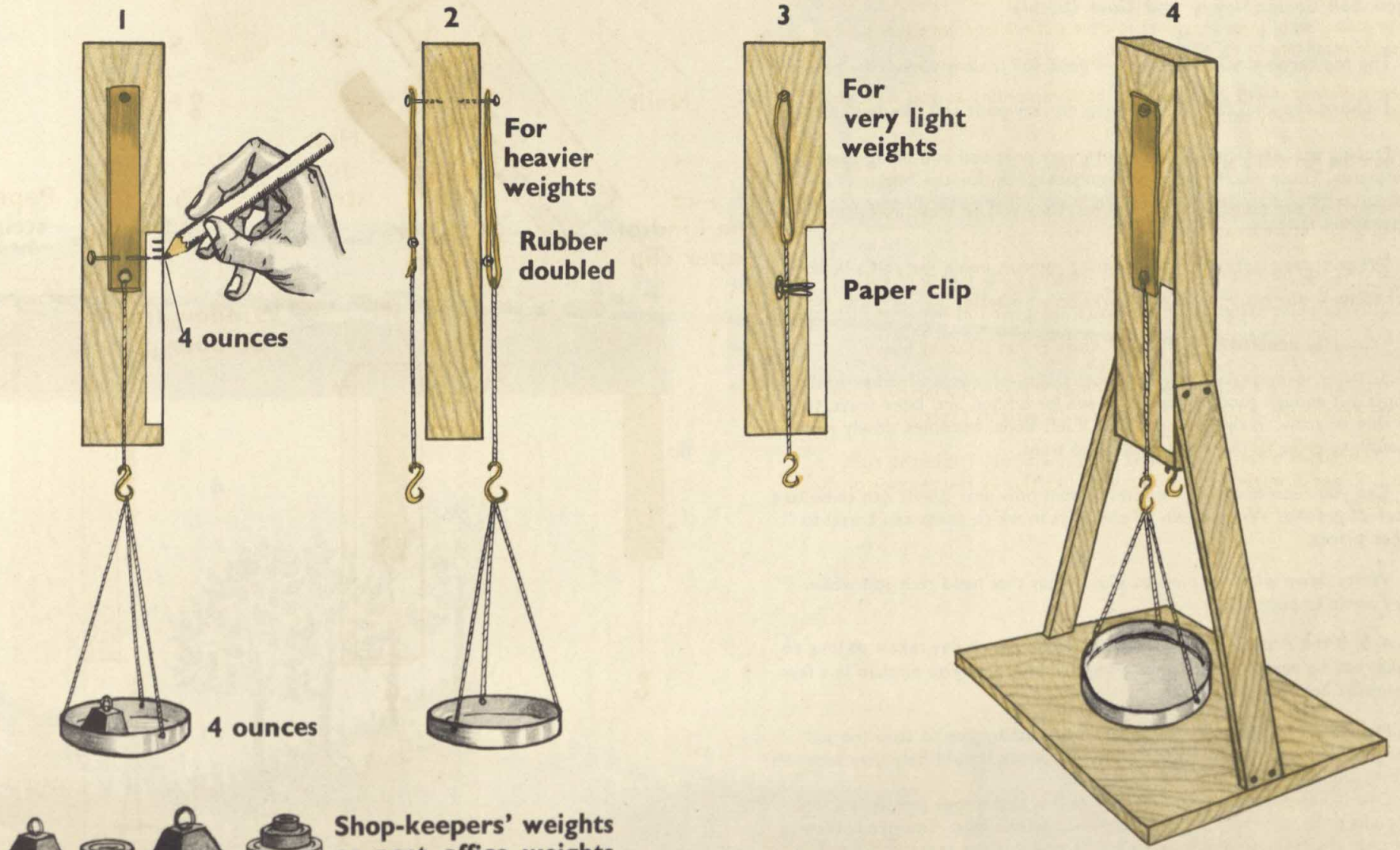
2. You may double the rubber to weigh things twice as heavy.

3. Use an elastic band for weighing light things. *Only the two kinds of paper clips shown in the picture will show the weights exactly.*

4. This makes a better and more permanent job. Those the class make 1, 2, and 3, might be put on stands like this by the teacher or the older boys.






1
2
3
4
For heavier weights
Rubber doubled
For very light weights
Paper clip
4 ounces
4 ounces
Shop-keepers' weights or post office weights

WATER AND SOIL

Good Soil Comes Slowly and Goes Quickly

The top three pictures show how good soil is slowly made by nature.

1 shows the kind of plant growing on very poor soil like bare sand.

During the week find a place with very poor soil and bring some of the plants. Those who bring them can label them for the Nature Table and enter the details in their Nature Diary. Next week all of you can draw some of these.

When these plants die, their rotting remains make the soil a little richer.

2. When this has gone on for years, the poor soil becomes rich enough to grow some grasses and later one or two other small plants.

3. After many years the grass roots and the remains of other small plants put enough goodness into the soil for bushes, and later trees, to be able to grow. In this way the soil, if left alone, becomes slowly rich enough to grow all the usual plants and trees.

Can you remember from earlier lessons how new plants can come to a piece of ground? Write down all the ways in which seeds can travel to other places.

Write down what happens to plant seeds that need rich soil when they come to poor soil.

4, 5, 6 and 7 show how this precious soil, which has taken so long to make, can be very quickly swept away and lost. Can you explain in a few sentences how this happens?

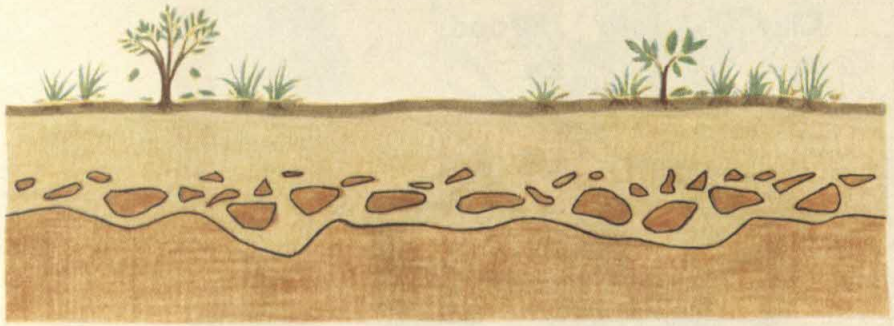
Make a list of the ways that farmers and others use to stop the soil being washed away. Your experiments last week should help you with this.

One other thing you should know is that sometimes people wait too long after the rains stop before they burn off the land. The fire is then so hot that the trees are completely killed, and it is the same as if you had cut them down.

1

4

2



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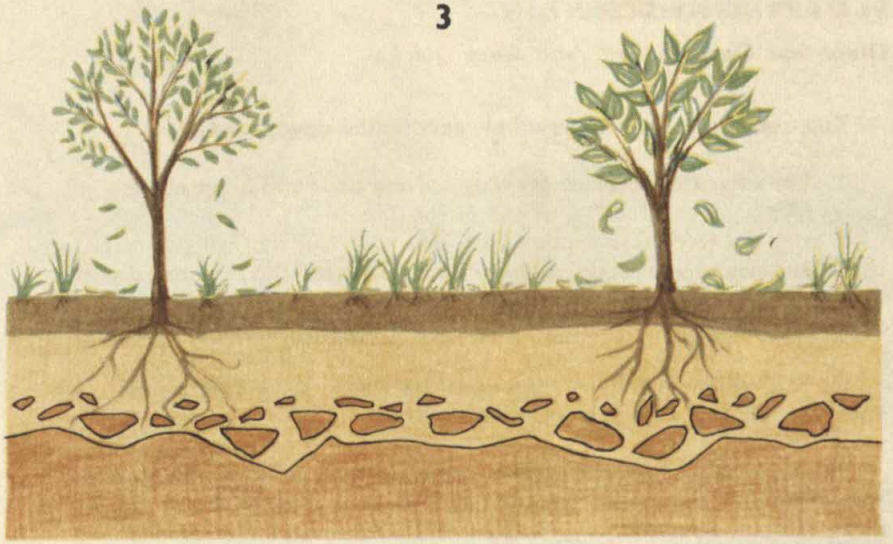

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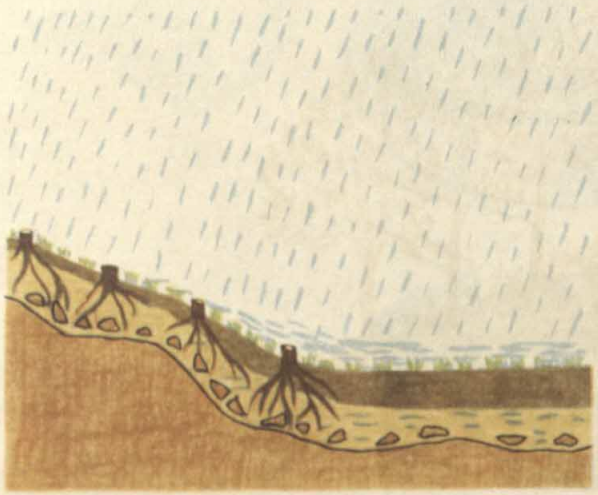

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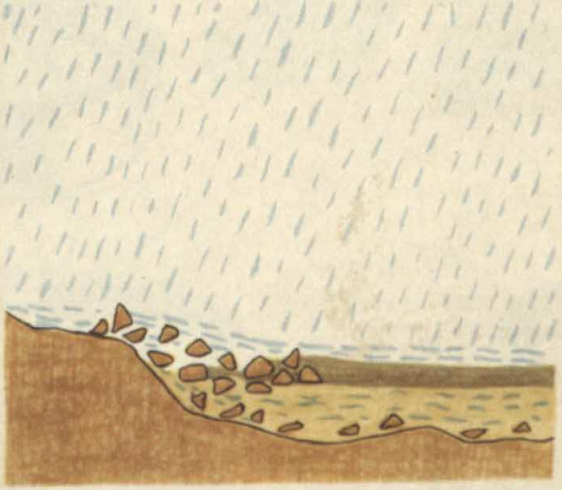

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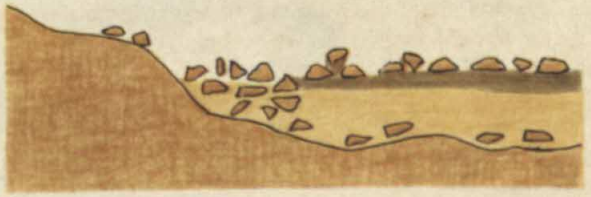


FLOATING AND SINKING

Shape and Floating

Take care that you have everything ready for this the day before.

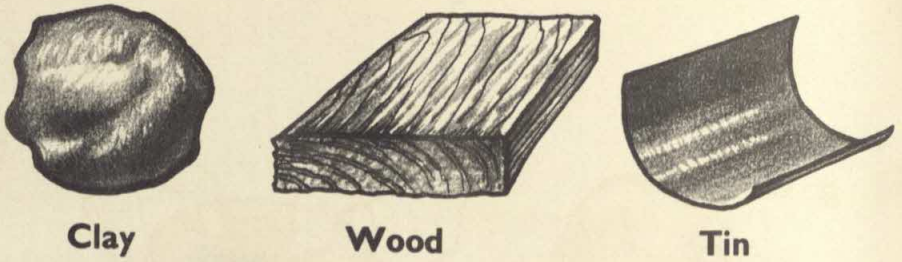
A. Try other things besides clay, wood and tin. Make a list of the things that float, and another of those that sink.

B. Try making the same lump of clay as you used in A into the shape of a bowl. Make it as thin as possible. Put it gently on the water. Has the clay become any lighter? Do you still think it weighs the same?

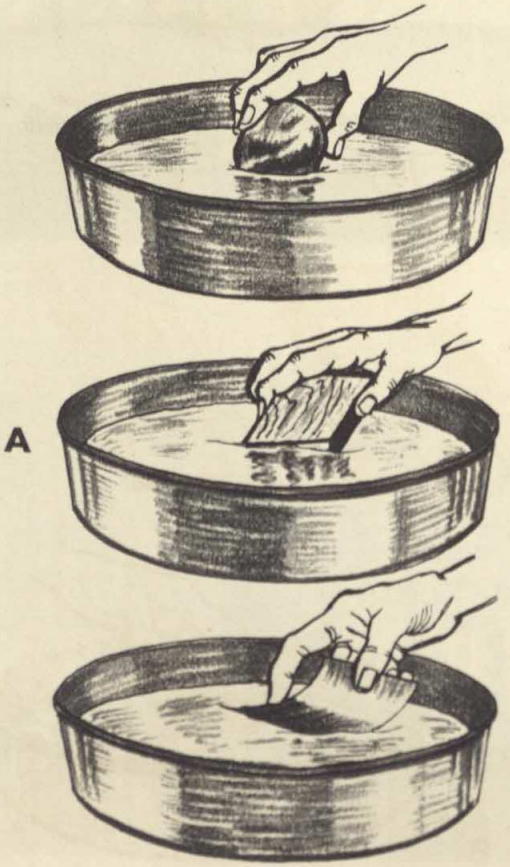
C. Fold the tin as shown. Place it on the water. Why does it float now, when it sank before in experiment A?

With the help of your teacher say what we have to do to the shape of heavy things to make them float. Write it down if you can. If you cannot think this out, do not worry. You will find it easier to understand after next week's lesson.

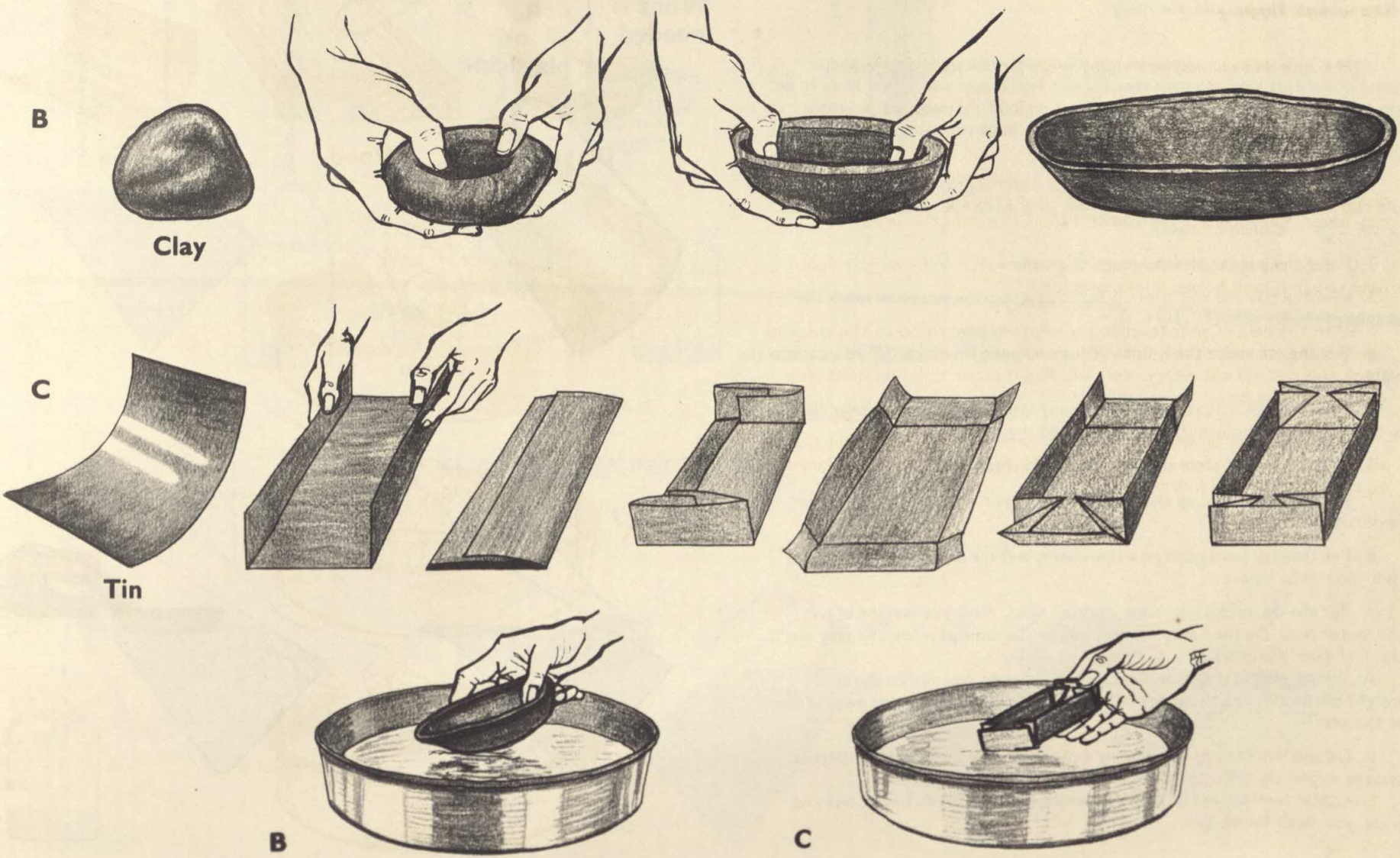
Get things ready for next week's lesson early. It is very important that you all take part in next week's experiment. Make sure you help by bringing all the things needed in time.



Clay **Wood** **Tin**



A


B
Clay
C
Tin
B
C

FLOATING AND SINKING

More about Shape and Floating

Here is a more exact experiment to find out what altering the shape really does. This kind of experiment is the first one in which you have to do some careful measuring and is a good example of the way real scientists try to discover how things work. Like their work, it has an exciting discovery at the end of it.

1. The jug must be arranged so that the water is just ready to pour out and will drop straight into the jar and not drip down the side. You will have to try this out once or twice.

2. Hang the jam jar on the weighing machine.

3. Wet the clay and roll it into a ball. Put it into the jar. Now mark the weight of the jar with the clay in it.

4. Put the jar under the lip of the jug and gently put the ball of clay into the water.

5. Now put the jar back on the weighing machine. Does the water spilt over weigh it down as much as the clay and the jar?

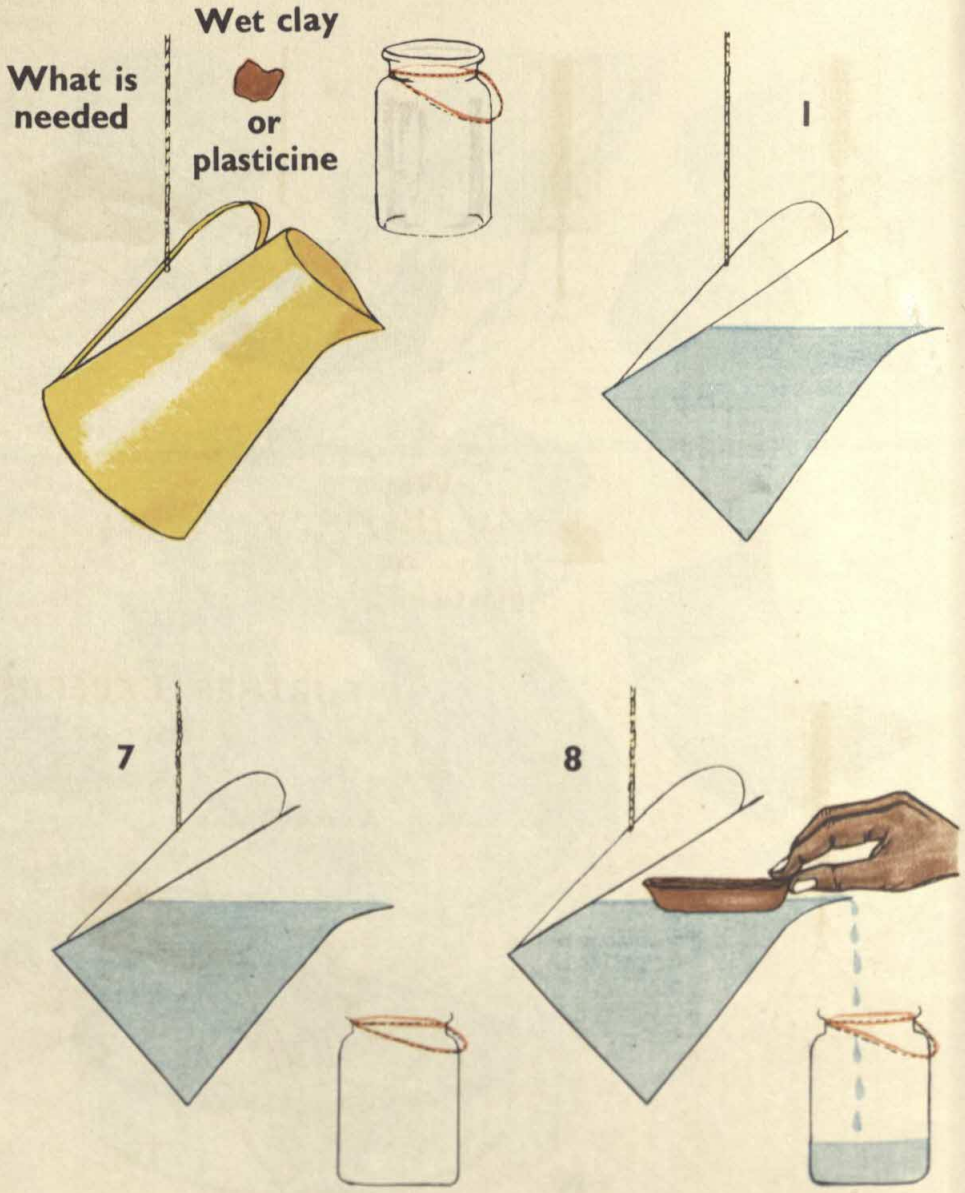
6. Make the same piece of clay into a thin shallow bowl.

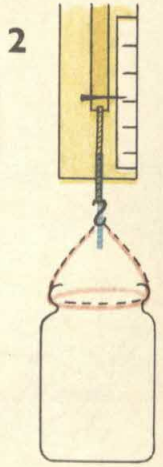
7. Empty the jar. Fill up the jug to the lip again and put the empty jar underneath.

8. Put the clay bowl gently on the water. Is there more or less water spilt over than before?

9. Put the jar on the weighing machine again. Mark the weight of jar and water now. Do they weigh more, less or the same as when the clay was in the jar? (See picture 3.)
As the jar weighs the same all the time, what do you notice about the weight of the clay and the weight of water that the floating bowl pushed out of the way?

10. Do the whole thing again using a piece of tin or a toy boat. Different groups might try different things.
Use these instructions to help you write down what you have done and what you have found out.



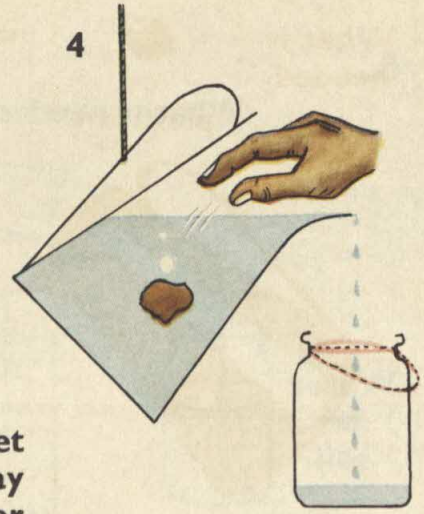


2

Empty jar

3

Wet clay or plasticine



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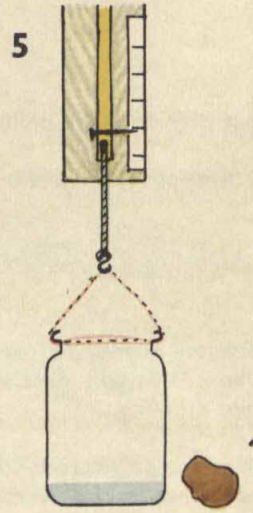

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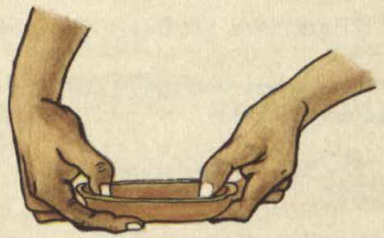

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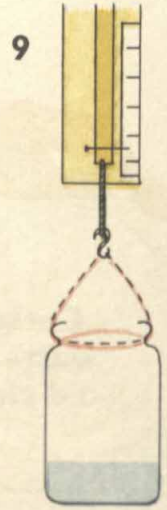
FURTHER EXPERIMENTS



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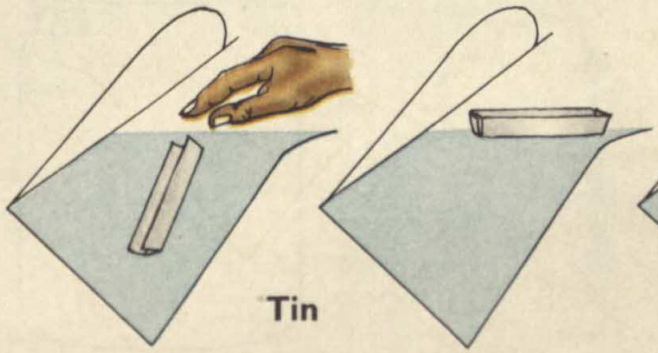
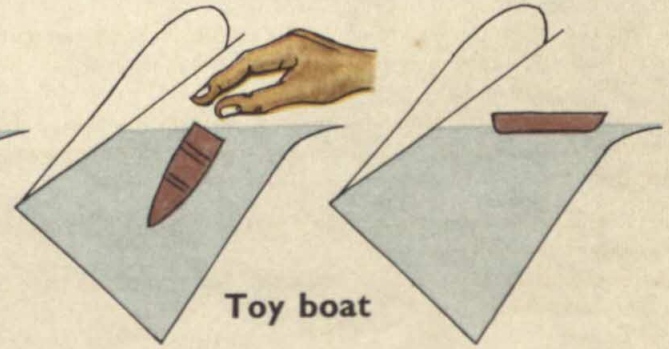


Tin



Toy boat

Plants Move

Yes. Plants move, not freely like animals but they do move deliberately.

These two experiments can be done by groups. Have plenty of material ready before the lesson.

A2. The box must be sealed so that light can only get through the hole you have cut.

A3. This shows the drawing you are to complete in your nature study writing book next week, when you open the box. Then you must write what you have learnt from this underneath your drawing.

B. This needs more care than A. The cloth or cotton waste is to stop the soil going into the little bottle and making the water run over. This would spoil your experiment.

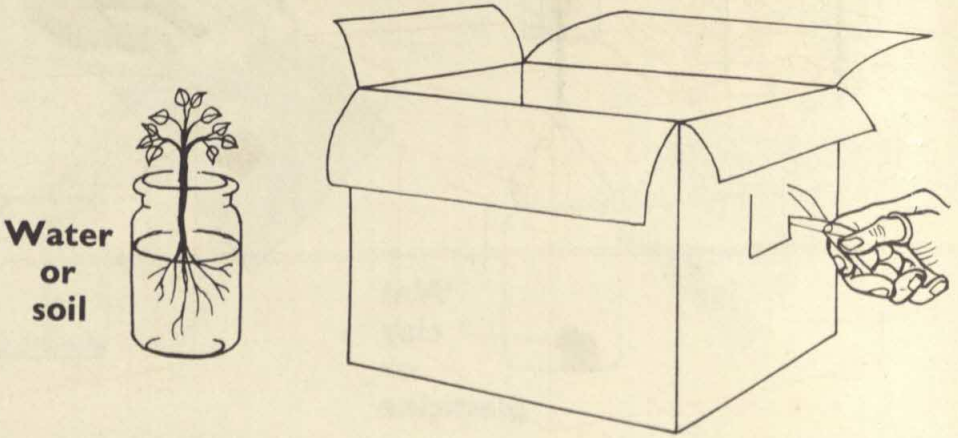
It would be better to tie a piece of cloth over the top of the little bottle. Do not fill it to the top, leave half an inch.

Be careful to arrange the plant against the side of the larger jar so that you can see the roots well.

B3 should be completed in your notebook next week, and you should also write down what it tells you about the roots of a plant.

A

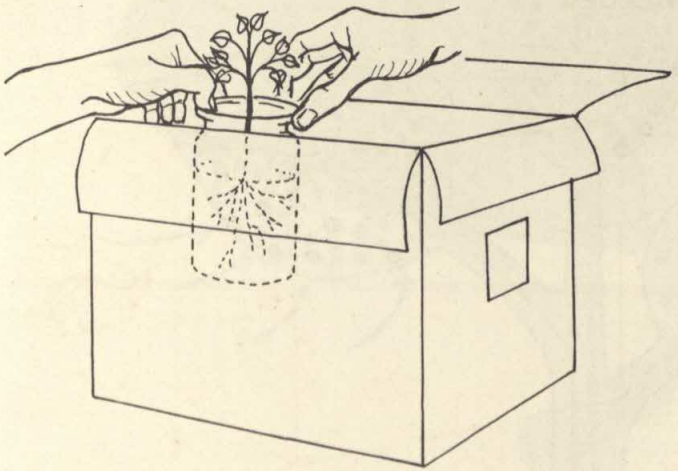
What is needed



B **What is needed**

A

1



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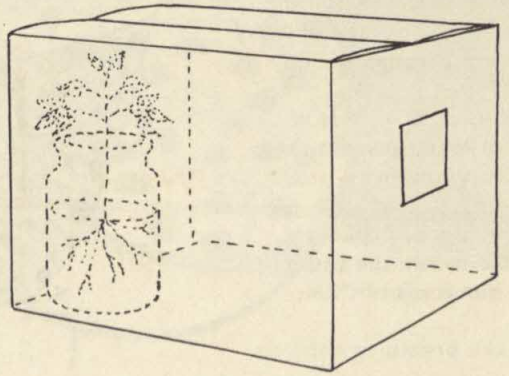

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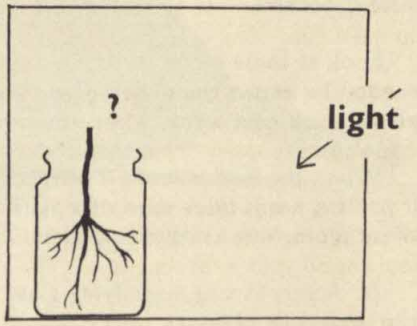
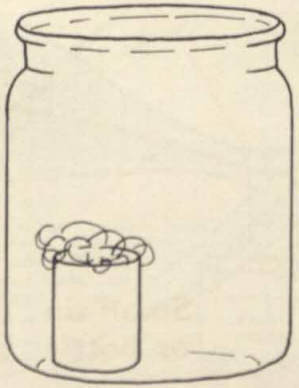


B

1



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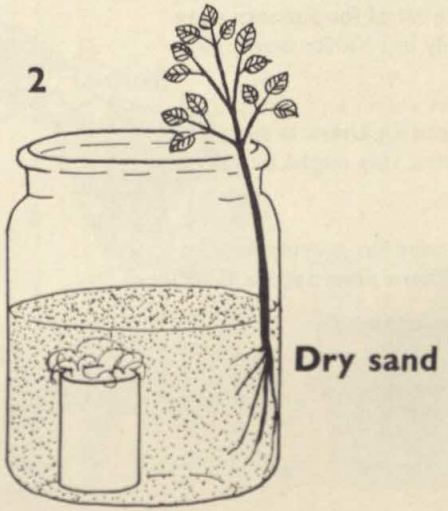

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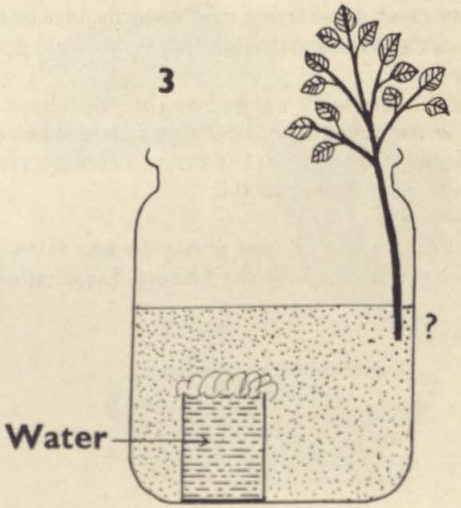


THE LIVING PARTS OF PLANTS

Plants Make Their Own Food

These pictures are only diagrams. They are not the sort of thing you really see. They are to help you to understand what goes on. To see these things properly you need something called a Microscope, which makes things look a hundred times bigger than they are. But if anyone has a *magnifying glass* you may be able to see some of them. *Your teacher will get one or two of these if possible.*

Look at these pictures. A. Think hard, then make a list of all that is needed to keep a plant alive. Can you say how each of these get into the plant?

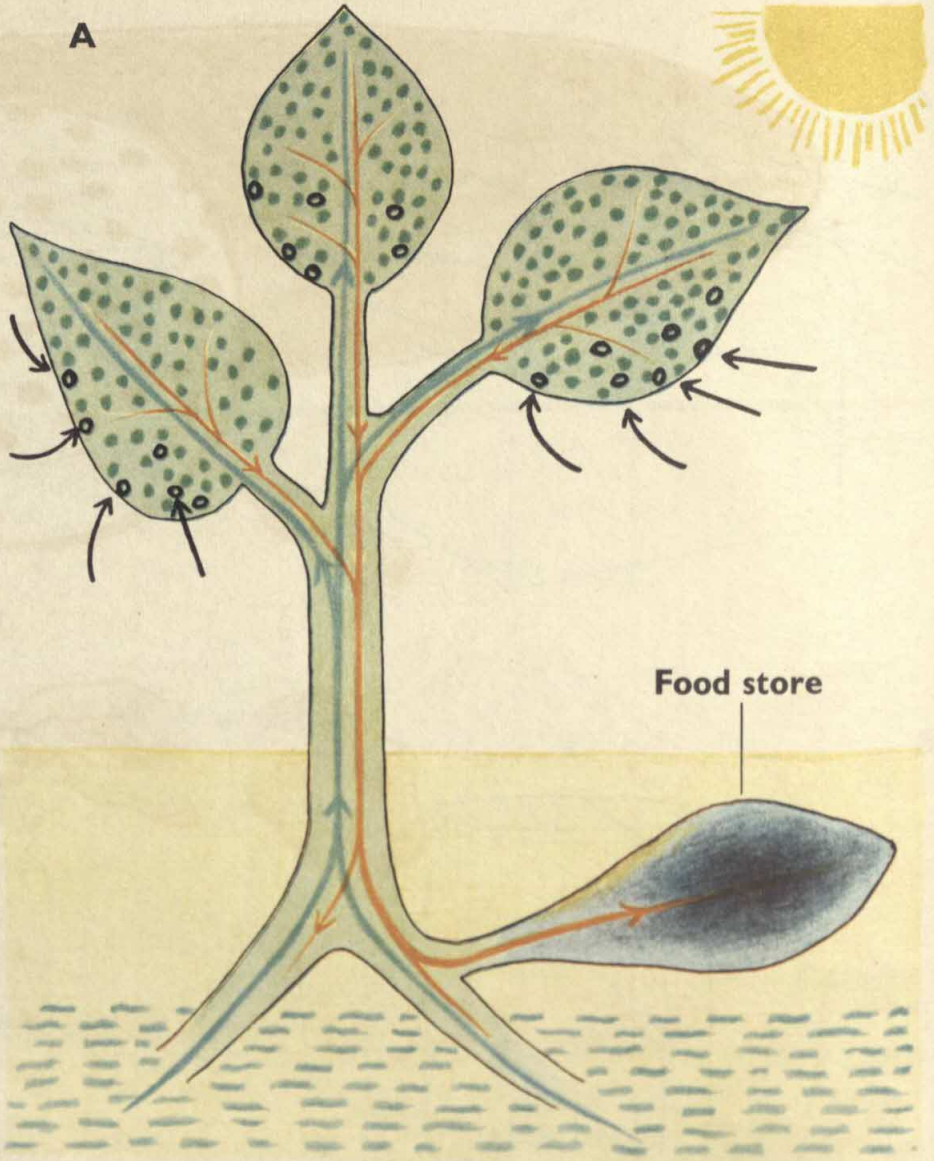
When the food is made it moves through tubes or pipes in the plant. If you cut a soft thick stem of a plant, you may be able to see the ends of these pipes with a magnifying glass. There are often hundreds of them.

B. A very strong magnifying glass will show you the breathing holes on the underside of leaves.

C. Your potatoes and cassava are really the food-store part of the plant. Here is an experiment to give some idea of the kind of food plants store up. Can you suggest what this food could possibly be? Write down your answer.

In parts of other plants, fruits and stems especially, there is another kind of food. It is sweet to the taste. What do you think this might be? Write down your answer to this.

What other parts of plants do you think are used for storing food? Make a collection for the Nature Table called 'Where plants store their food'.



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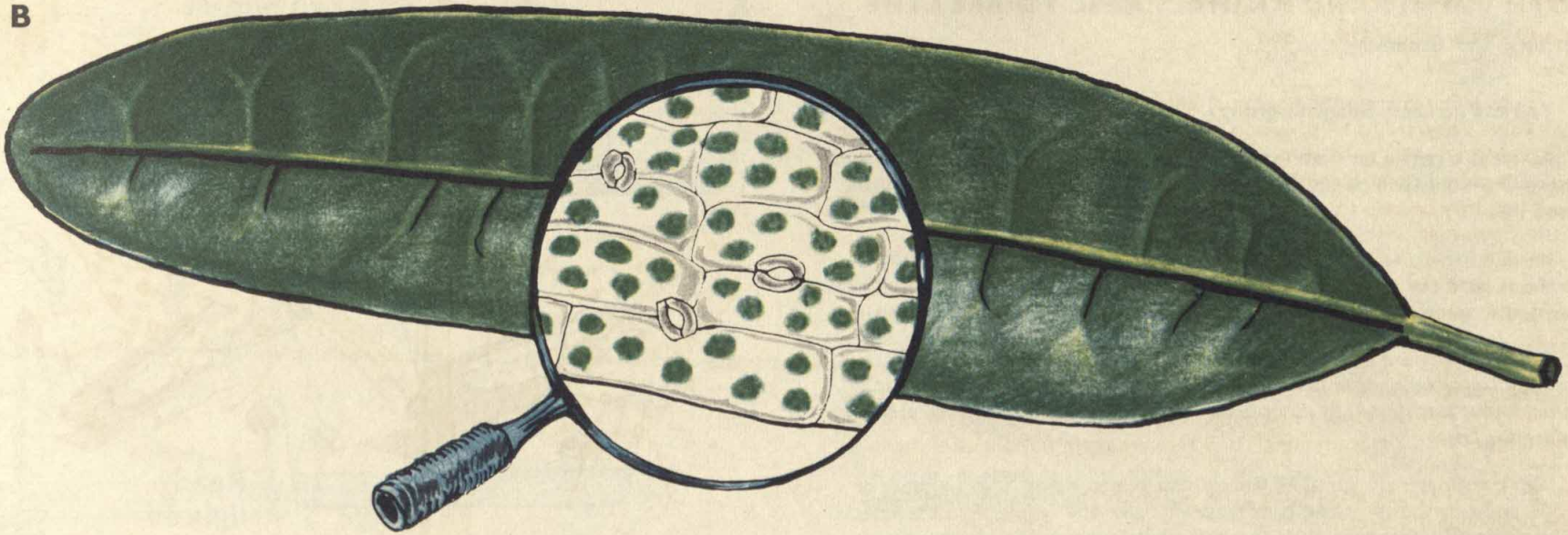

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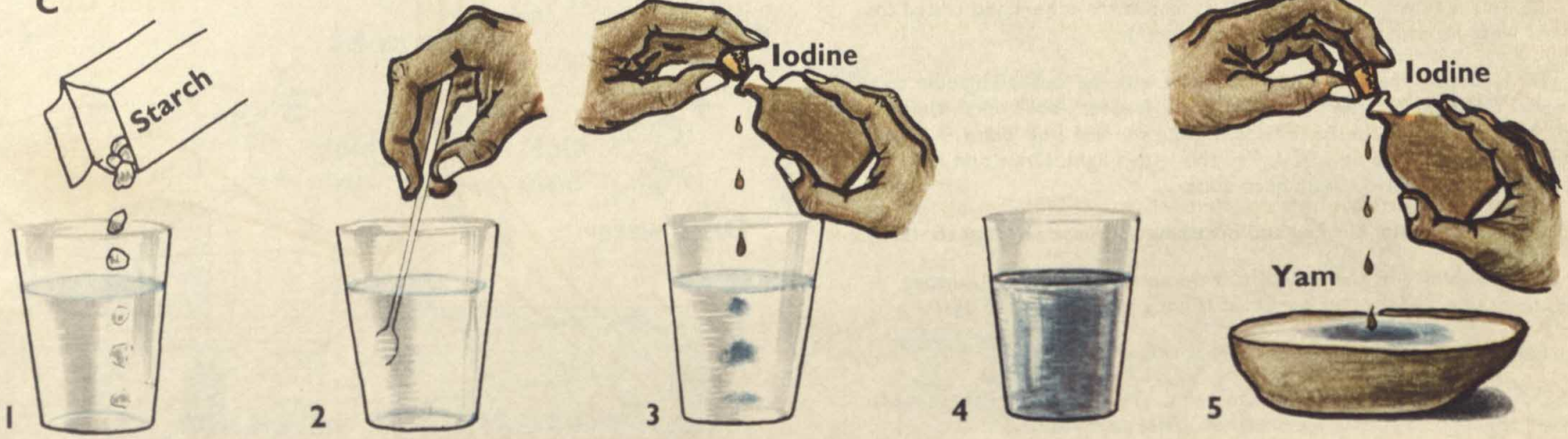


BOTH PLANTS AND ANIMALS NEED TO BREATHE

Burning and Breathing

You can do these things in groups.

A. Float a candle on a tin lid under a jar as shown. The dotted line shows where the water will be up to when the burning is finished. Some air is 'used up'.

Have a lighted splinter of wood or straw ready, and when the candle goes out push the card under the jar and gently lift the jar up. Keep it upside down and quickly put the light in. Draw what happens. Label the drawing.

B. In the bag are grasshoppers or cockroaches caught the day before. *(Use the traps described in Book 2.) As this takes longer than the burning perhaps your teacher will fit up at least one of these experiments several hours before the lesson.*

Wait until you are sure the water has stopped rising. Light a piece of wood and test the air in the jar. Draw and label the result. Are the insects alive or dead? What have they and the candle done to the air that was in the jars? Write down your answers to this.

C. This is an empty jar to be left as long as the others and tested too. Draw what happens and say why it is different.

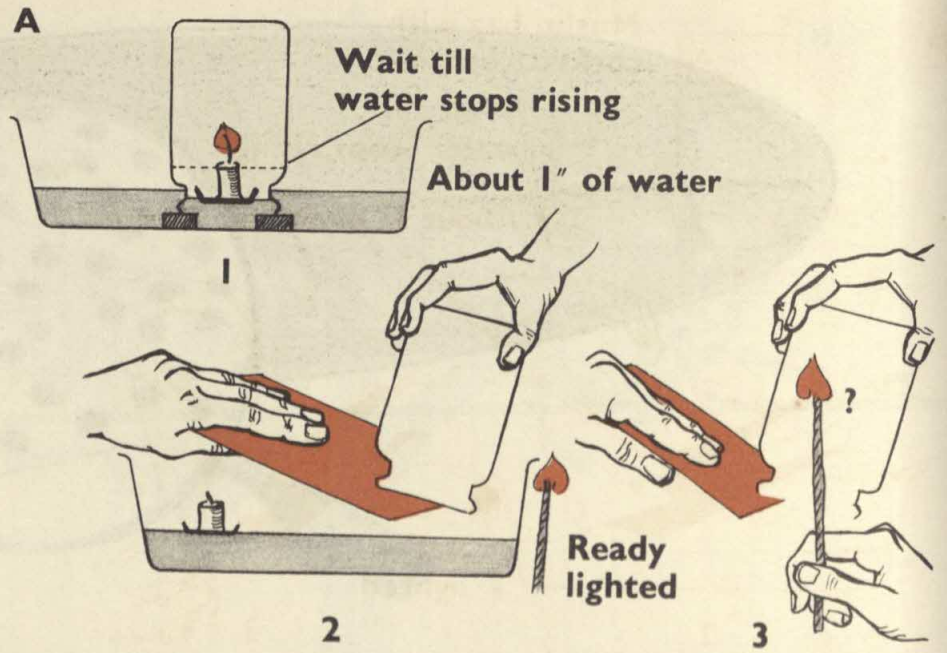
D. 1. Prepare the jar as shown. 2. Start with the football bladder completely empty. You must breathe in and out of the bladder about seven times before you have used up all the air. This will make you feel a bit dizzy. 3. Now fill the jar with the 'used up' air. 4. Try this with a light. Draw and label the result. Write down what you have done.

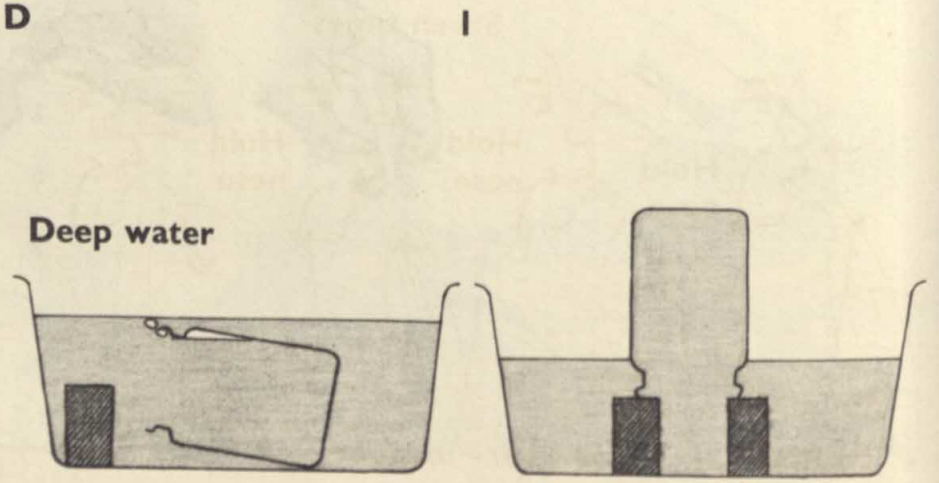
Do you think that burning and breathing do the same thing to the air?

Do you think that there is part of the air that is good for burning and breathing, and another part that is not good for these things?

Think carefully and write down your answer.

Do you think there is more than one kind of air, and are these kinds mixed together in the air we breathe? Write your answers.





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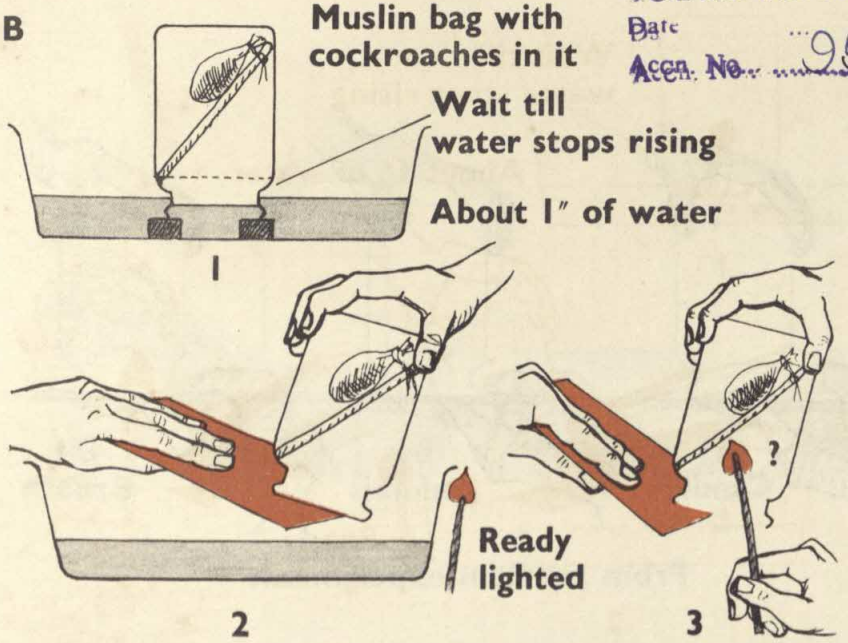

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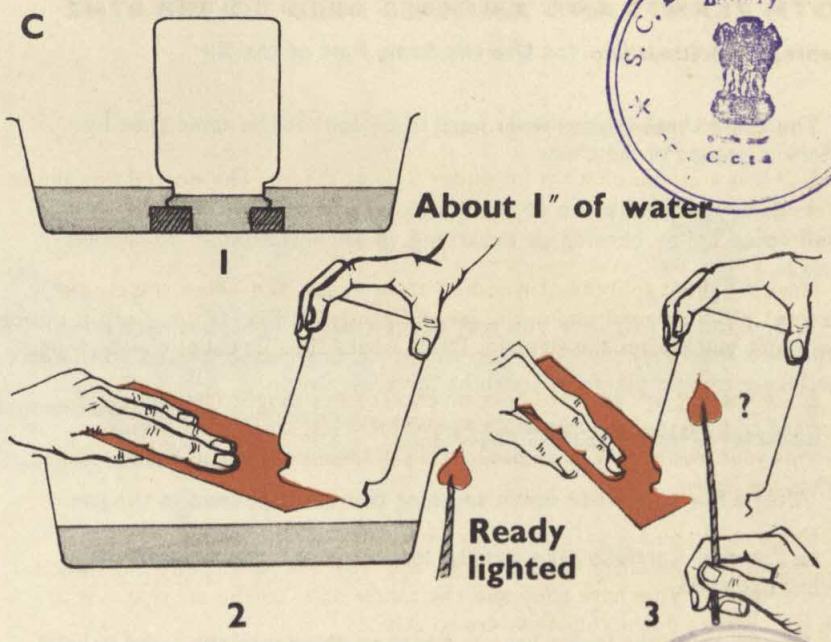
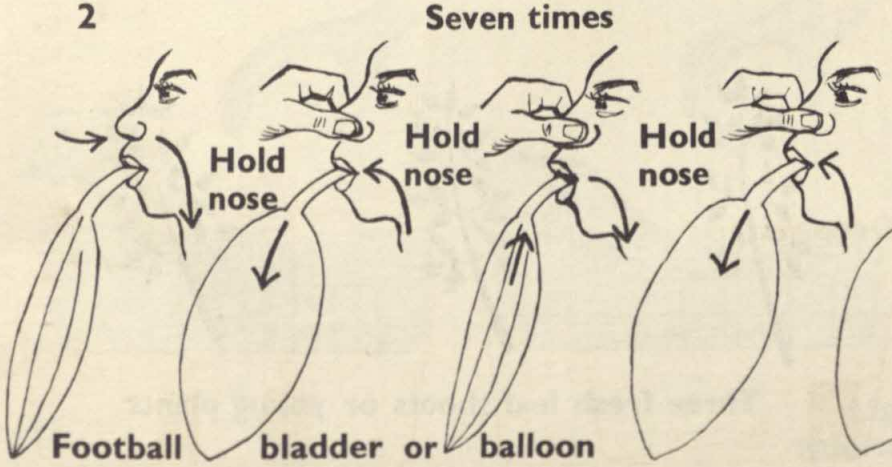
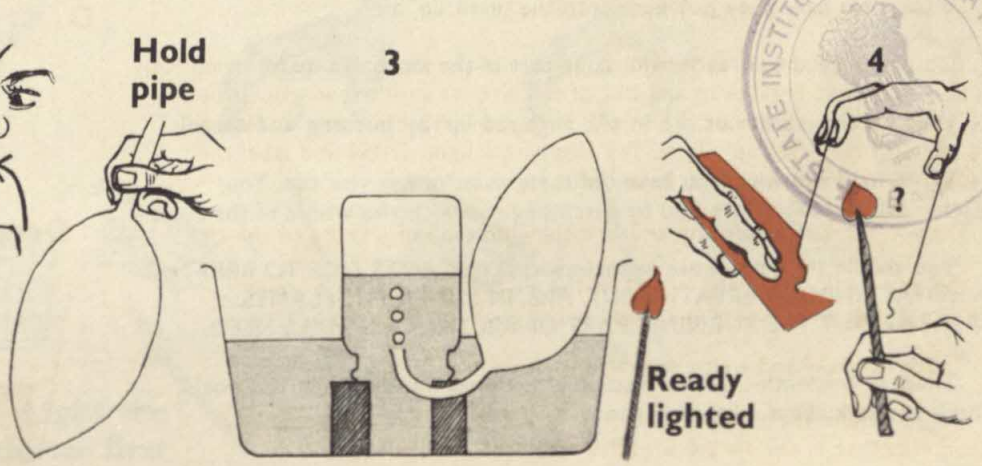






BOTH PLANTS AND ANIMALS NEED TO BREATHE

Plants and Animals Do Not Use the Same Part of the Air

There are three experiments here to be done at the same time by different groups in the class.

1. Each group does one of *last week's experiments A, B or D*, to get a jar of air 'used up' by burning or breathing. (*B will have to start a few hours early.*)

2, 3, 4 and 5. This time you will not test with a light, but each group will put a *fresh leafy shoot* carefully in the jar. Leave each jar and bowl where the leaves can get plenty of sunshine for a few days.

Now write down what you have done.

After a few days write down anything that has happened in the jars.

6, 7 and 8. Carefully take out the leaves and test the air with a light. What happens?

Do you think the leaves have put back anything into the 'used up' air?

If so, what have they put back into the 'used up' air?

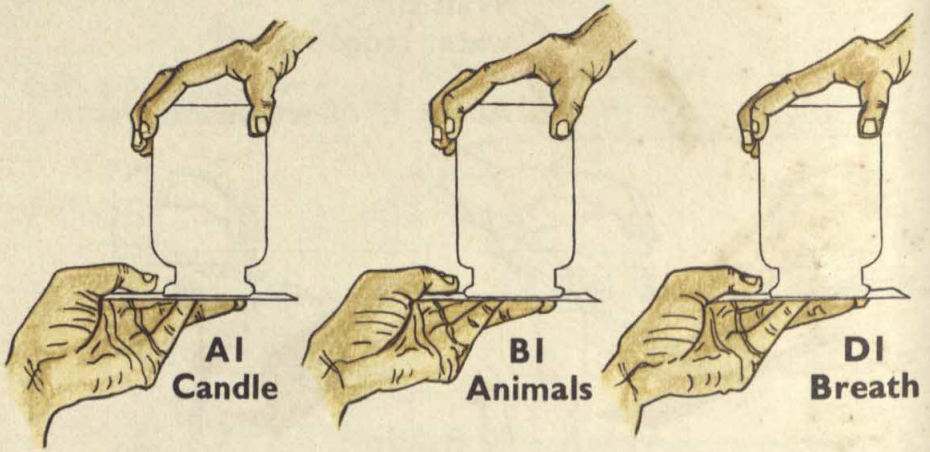
Do plants need to breathe the same part of the air as animals?

Why do the plants not die in the air 'used up' by burning and animals?

Think hard and answer as many of these questions as you can. Your teacher will probably help you by discussing this with the whole of the class.

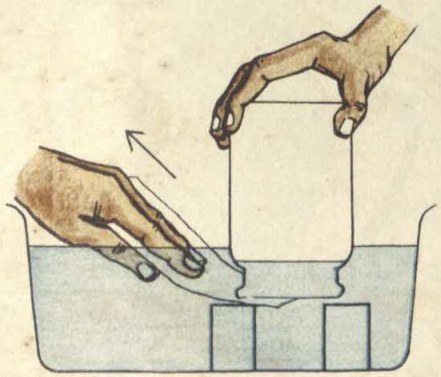
You should see from these experiments that PLANTS LIKE TO BREATHE *IN* WHAT ANIMALS BREATHE *OUT*. Also, IN SUNLIGHT, PLANTS BREATHE OUT THE BURNING PART OF AIR THAT ANIMALS NEED.

These two scientific facts are some of the most important in the world. Think and talk about what they mean.



From previous experiments

Three fresh leaf shoots or young plants



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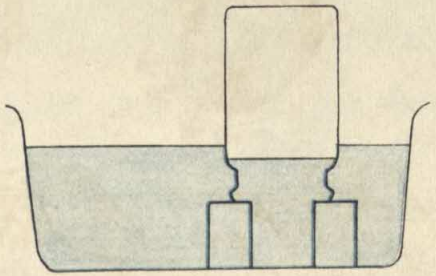

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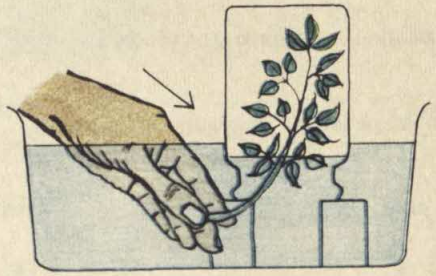

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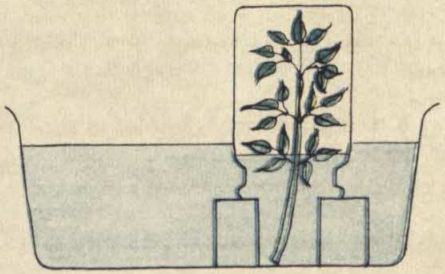

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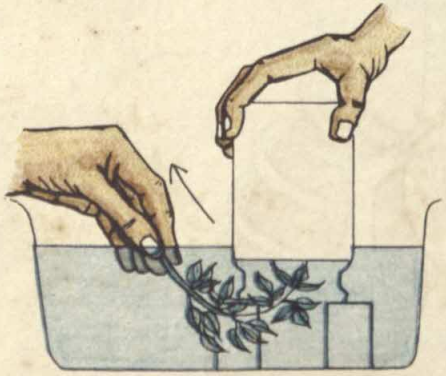

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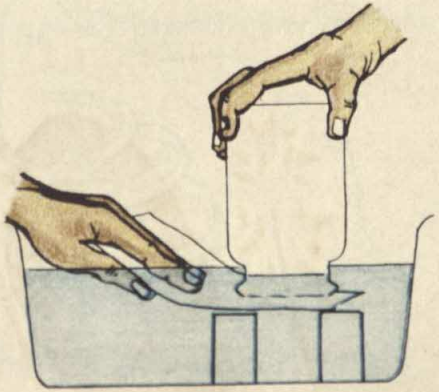

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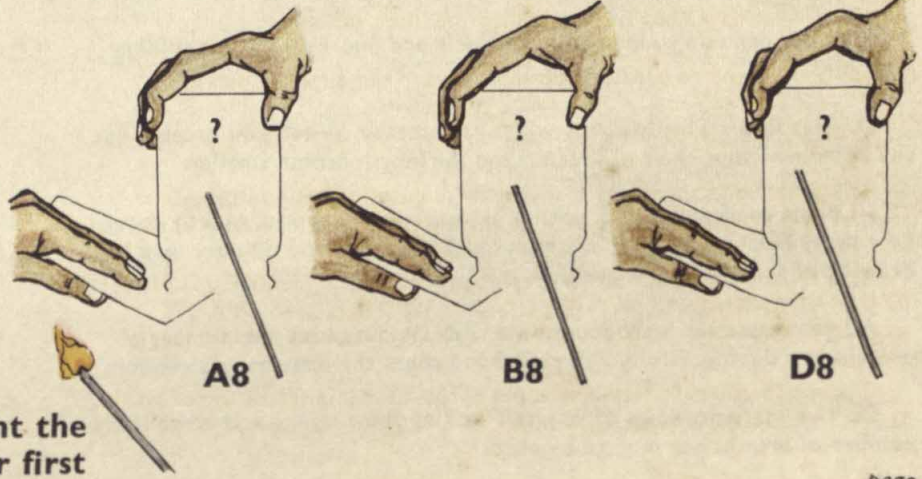


A8 B8 D8

Light the splinter first

BOTH PLANTS AND ANIMALS NEED TO BREATHE

More About Plants, Animals and Air

You have seen that burning and breathing use up the same part of the air. Animals take air into their bodies to use up this part of the air for energy. Here are pictures to show you how some of them do this.

A. Fish get the same kind of thing out of the air in the water (Book 2, page 29), as it passes through their 'gills'.

B. Some insects have holes in their skin which let air into tubes or pipes in the body.

C. We get air through our mouth and nose, and it goes into two sack-like things in our chest called lungs.

Examine a *fresh fish*. Find the gills. Draw this part and put in arrows to show that the water goes in at the mouth and out of the gills.

Why do you think the gills are red in colour? Write this answer under the drawing.

Examine a *large grasshopper*. Find the breathing holes. Draw and label them.

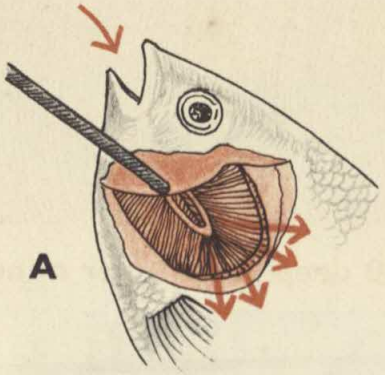
Put your hand on your chest. Breathe in and out. Feel the lungs filling with air.

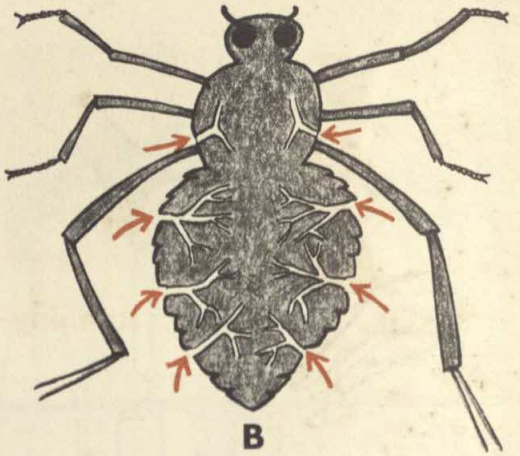
D. This shows what happens when you breathe. When you breathe out the bottom of your chest pushes up and the lungs become smaller.

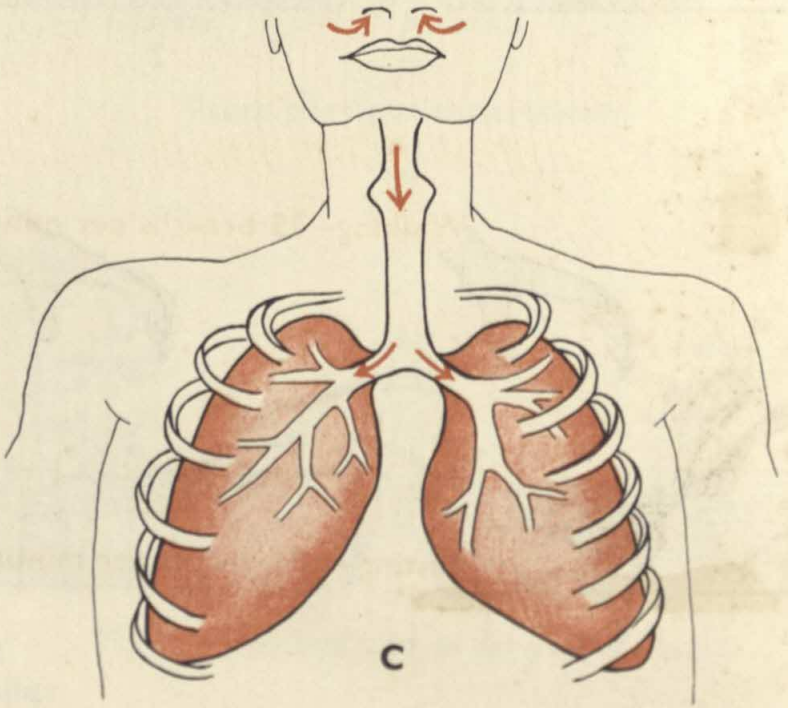
Sit or lie comfortably and, with your teacher timing you, quietly count how many breaths you take in a minute. Write down the number by a little drawing of yourself in this position.

All go outside and walk round in a circle. Again count the number of breaths in a minute. Finally run round and count the breaths in a minute.

Do two more drawings of yourself walking and running and write in the number of breaths per minute by each.







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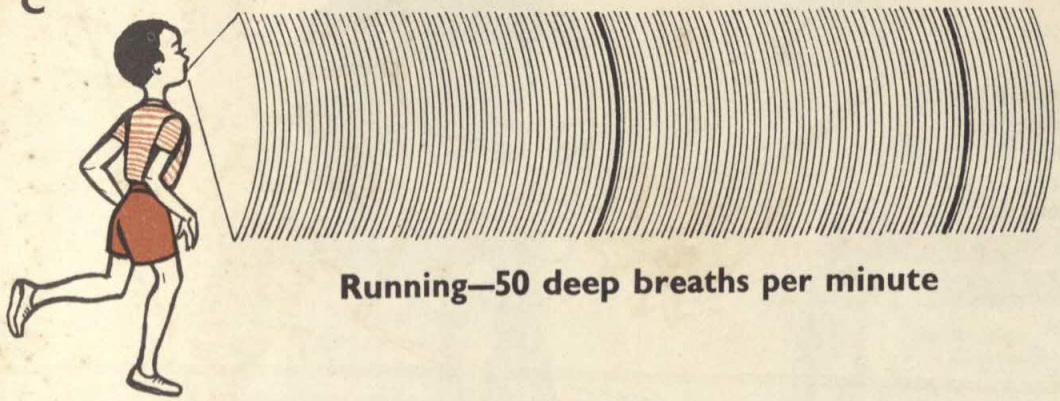
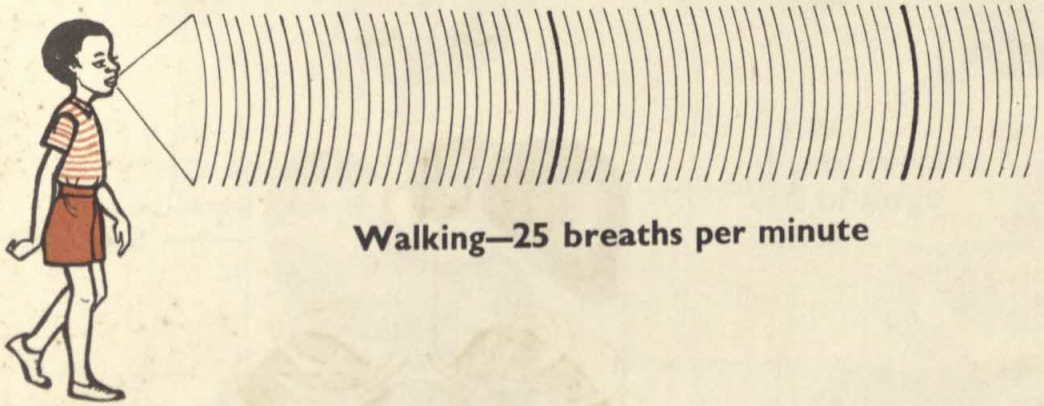
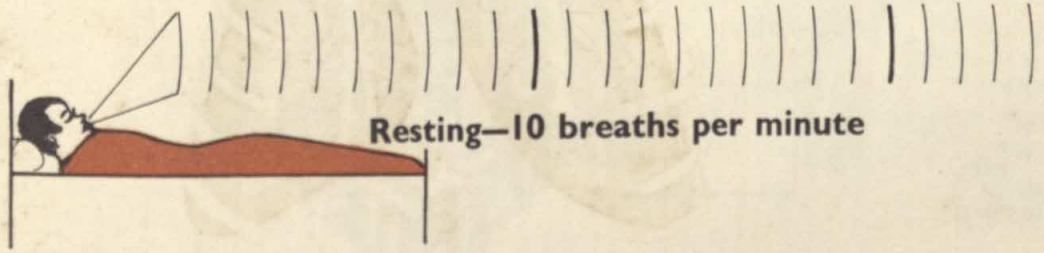


Running—50 deep breaths per minute

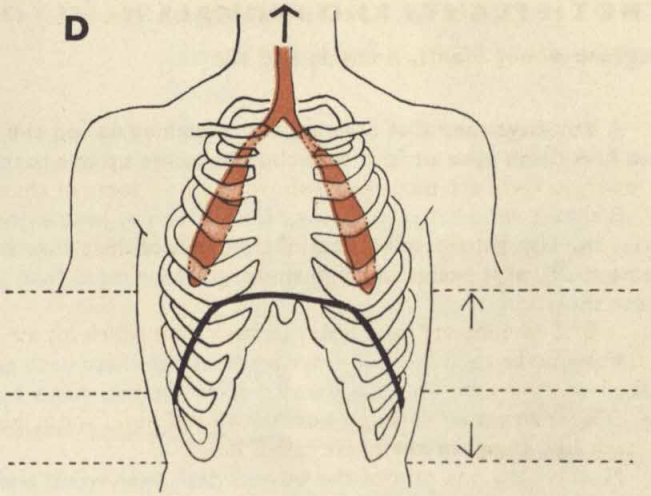


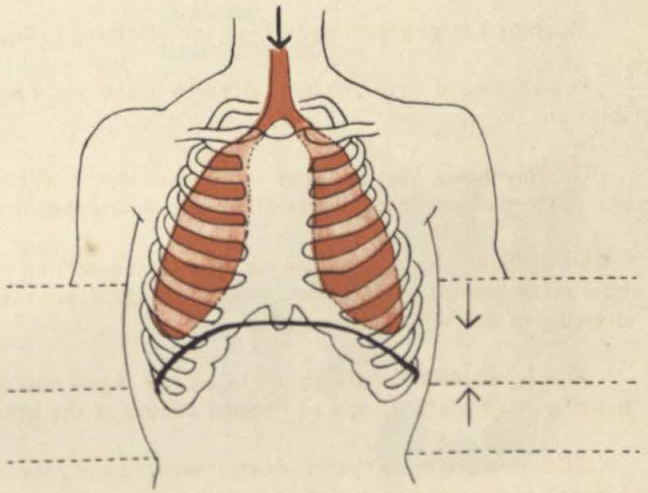
Walking—25 breaths per minute



Resting—10 breaths per minute

D





THE LIVING PARTS OF ANIMALS

Digestion

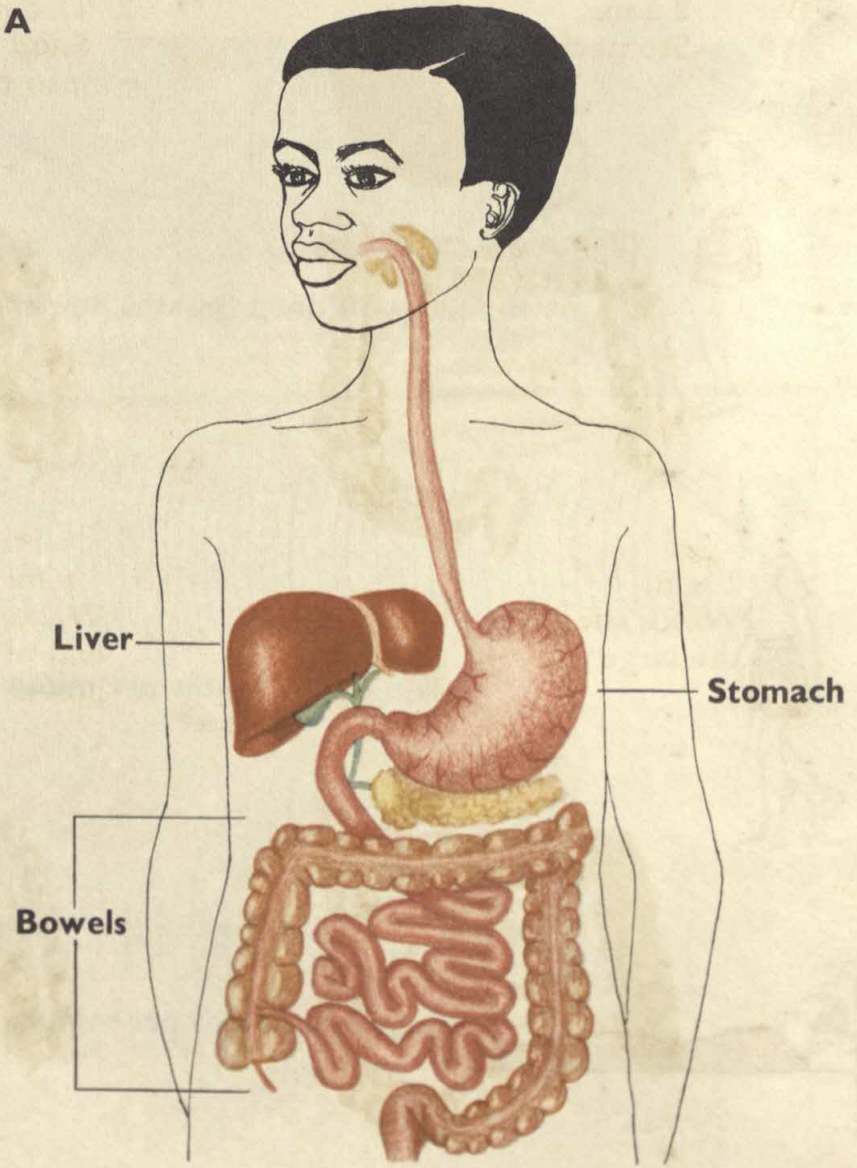
A shows you some of the most important parts of your body. See if you can find these same parts in some of the animals that are cooked for food.

B shows what happens to your food after you have eaten it. How long does the whole journey through the bowels take? It does not always take the same time in all people. Also most people have more than one meal in the time shown by the pictures.

If you have time try and draw pictures like these with another meal taken at say 2 p.m. You will have to show the two meals by different colours or different shading.

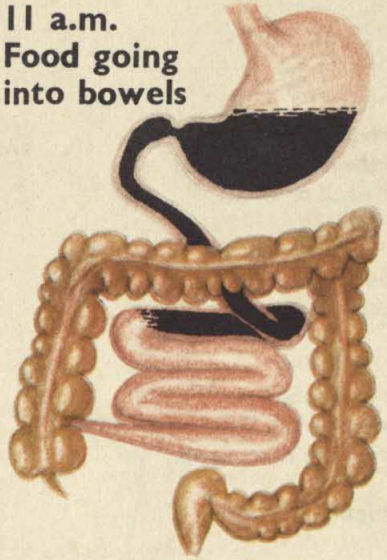
Notice how one part of the bowels deals with waste and the other parts with taking out the good food to be sent to the rest of the body. You will have some idea of how this is done in later lessons.

A



B 1. 8 a.m.
Stomach filled

2. 11 a.m.
Food going into bowels

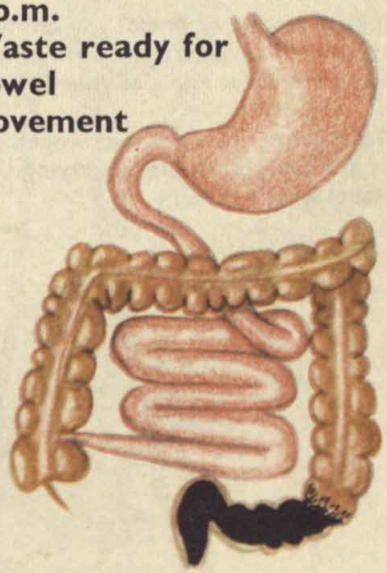


3. 1 p.m.
Good part of food absorbed. Waste goes on

4. 2 p.m.
Waste shown in the large bowel

5. 4 p.m.
Waste reaches end of large bowel

6. 8 p.m.
Waste ready for bowel movement



THE LIVING PARTS OF ANIMALS

The Heart as a Pump

A and B are two ways of showing water being pumped round and back to the same place. *The one with the long rubber tube is the better* and gives you some idea of how you can feel your heart-beat in your neck or wrist. (*You might borrow a tube from a lorry driver.*)

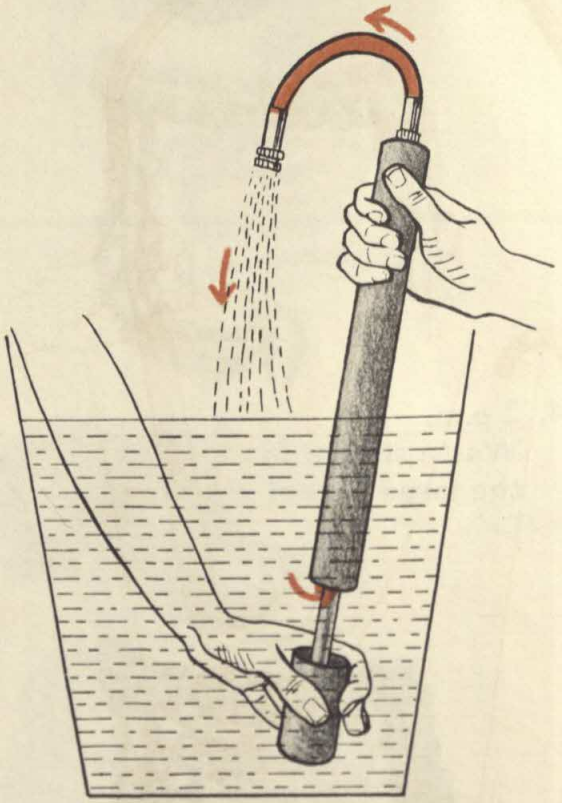
This experiment needs two of you to hold the pump and tube. The third pupil can hold the tube in the centre to feel the 'beat' as the water goes round.

C. In our bodies the blood is not pumped just through one tube but through very many. D shows how the main pipes enter and leave the heart so that the blood can be pumped round the body and back to the heart again.

Feel the heart-beat in your neck and wrist. Make drawings of any of the pipes' you can see under the skin of your own wrist.

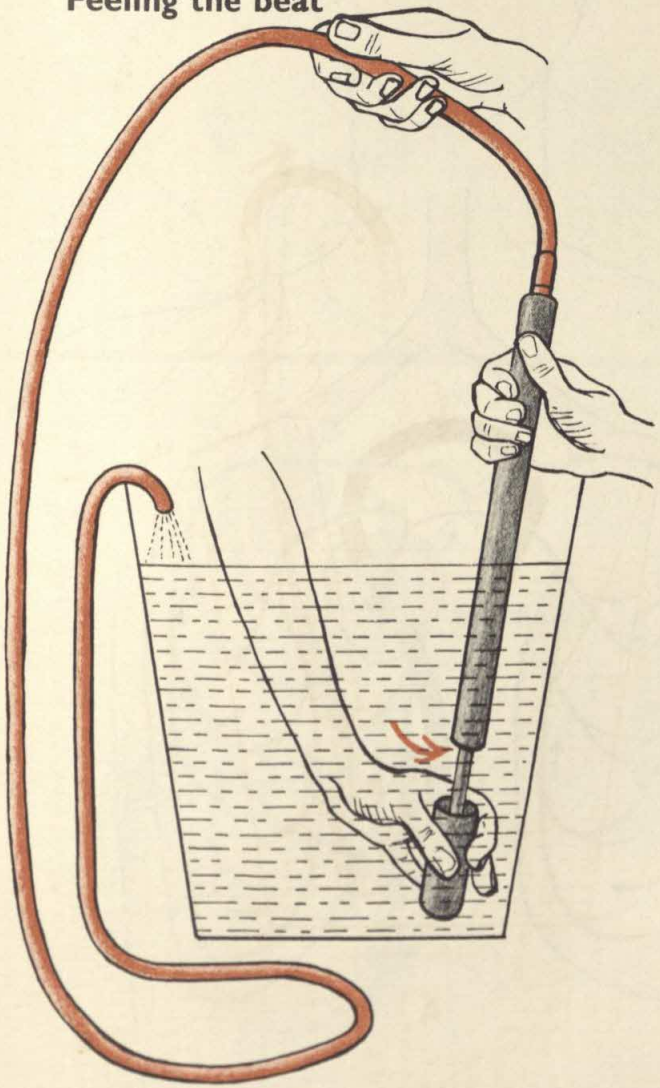
If your teacher or one of you can bring a sheep's heart or chicken's heart you can see where the main pipes join on. Draw what you see. Your own heart is about as big as your fist.

Your teacher may be able to open up a fresh fish and show you the heart and some of the pipes carrying the blood round the body. Again draw and label what you see.



A

Feeling the beat



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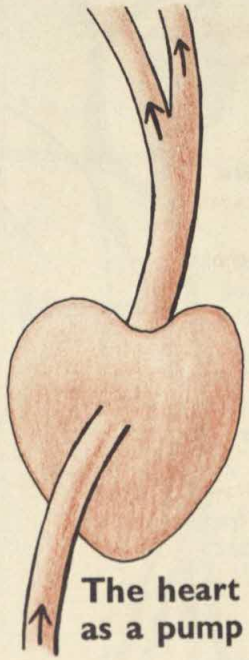
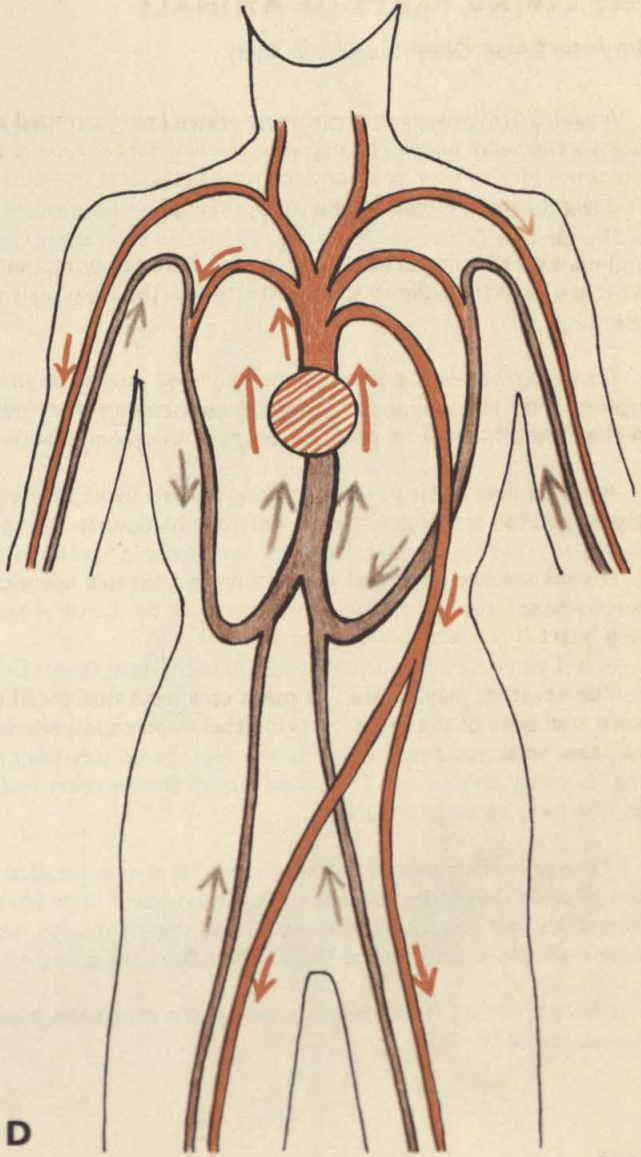


The heart as a pump

C



D

Why the Blood Goes Round the Body

These pictures give you the chief reasons for this. There are other reasons you will learn about later.

First let us think about the lungs. The blood goes there to get the part of the air that is used for burning. The blood then takes this round the body where it is used up, and then goes round back to the lungs for more. At the same time you keep breathing and getting fresh air each time into the lungs.

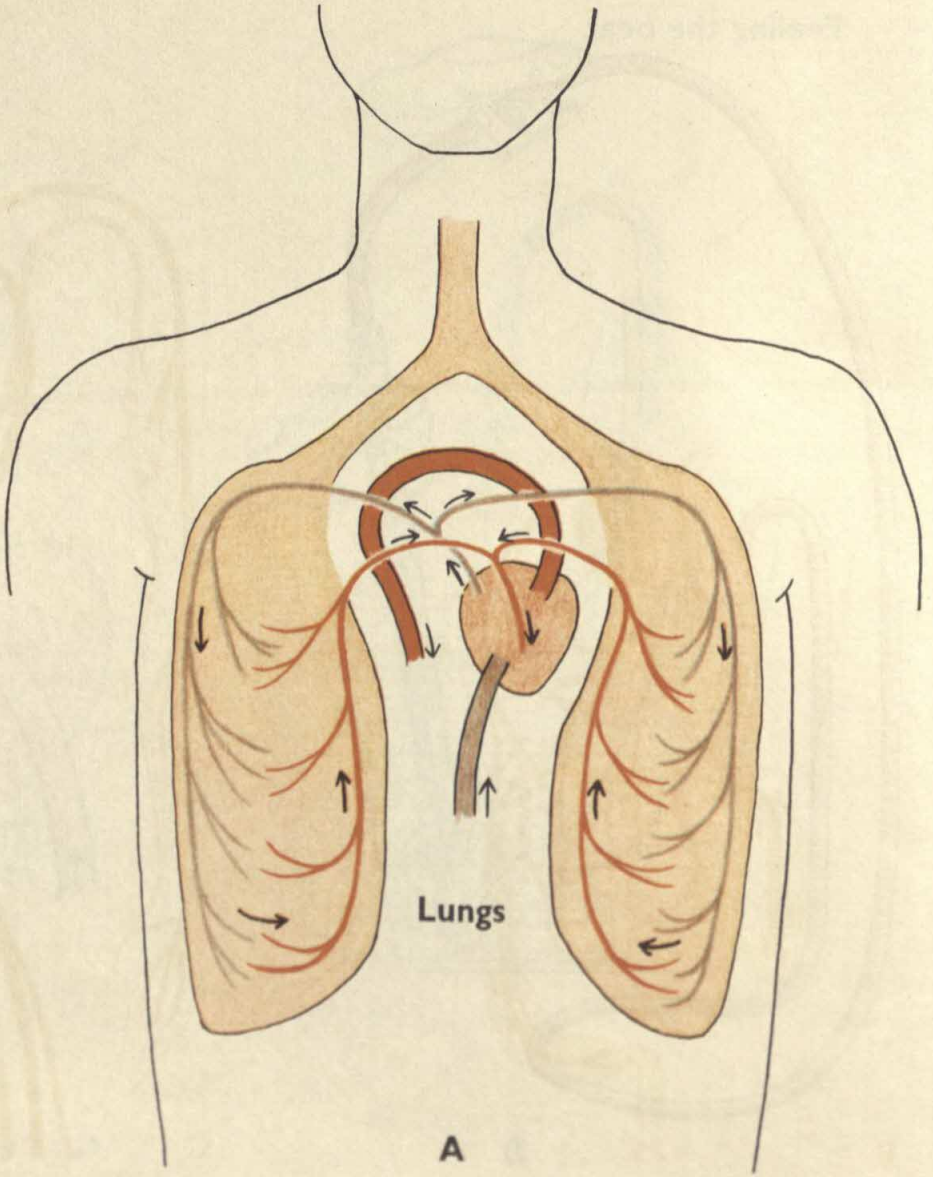
Look at A. Which pipes have the burning part of air in them, those coming from the lungs or those going to the lungs from the heart? Where is the thick pipe from the heart going to? Write your answers.

B. You have already seen what happens to food. The waste passes out of the body. The blood goes to the parts of the bowels where food is passing along. It takes out the good part of the food and carries it round to all the parts of the body that need it, and then comes back for more. Follow the way it goes.

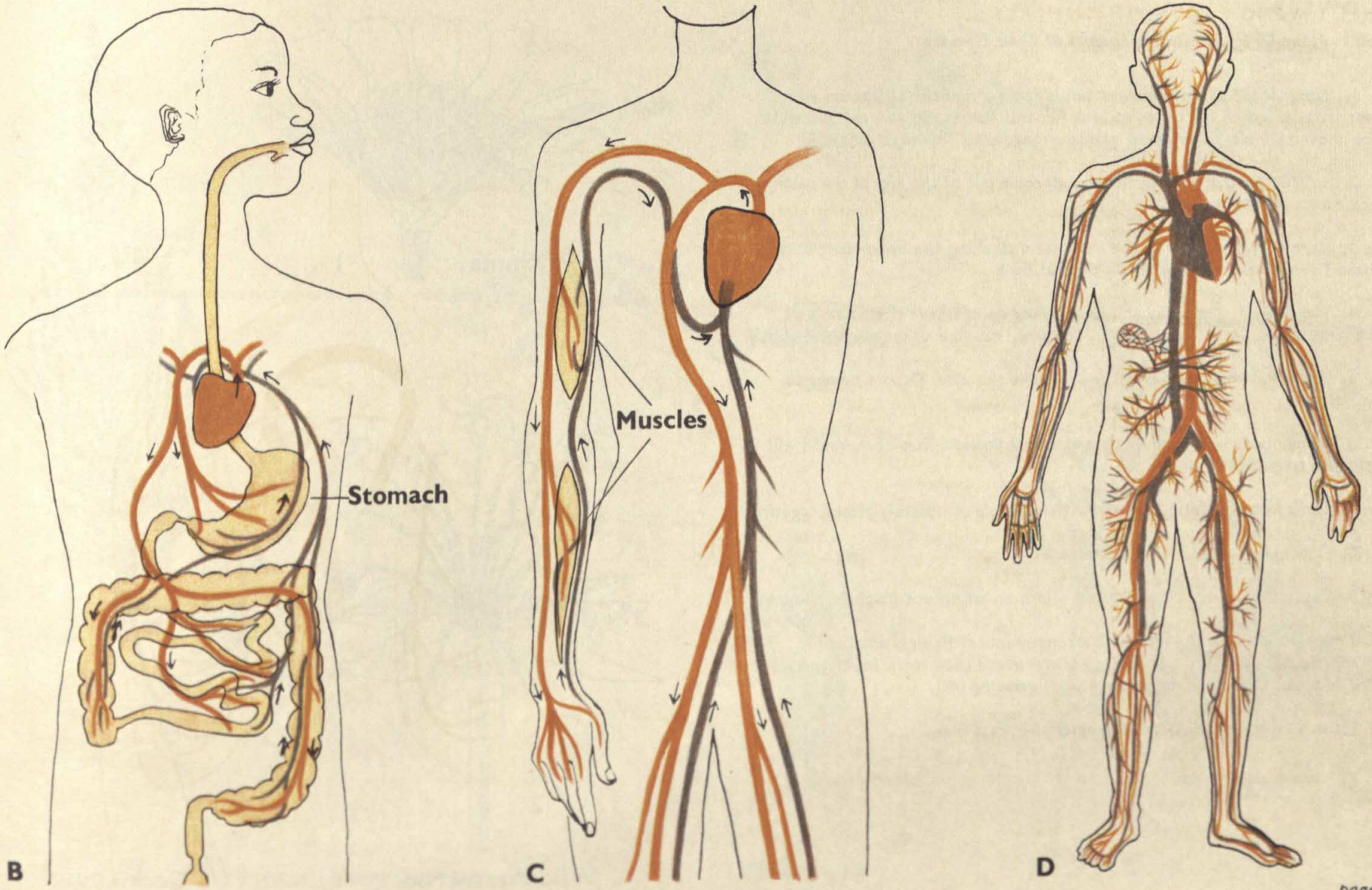
C. If you have not done this in the last lesson, look at the inside of a fish or small animal and see the pipes carrying blood to all parts. Draw what you see starting at the heart. Label as much as you can. In Book 2 you saw how muscles move arms and legs. To do this they need energy fron the 'burning part' of air. The blood brings this to them and takes the 'used up' air away to be breathed out.

D. Really the pipes, or 'blood vessels' as they are called, are more complicated than these diagrams. This gives you a little idea but there are thousands that are not drawn here. Note the pipes with 'used up' air are shown purple and are called veins. The others are called arteries.

Write a few sentences telling some of the things the blood does as it moves round the body.



A


Stomach
Muscles
B
C
D

FLOWERS

Plants Have Different Arrangements of Their Flowers

1. Zinnia looks like one flower but is really a number of flowers with their parts arranged in circles to look like one flower. So you see you must look more carefully to see how plants arrange their flowers.

2. In Wild Arrowroot the flowers all come out of the top of the stem, each on its own short stalk.

3. Here they grow out of the main stem all along the upper part of it. These flowers have no short stalk of their own.

4. The flowers of the Pea and Bean family do not have their petals all the same shape. This is a big famliy, see if you can find other members of it.

5. Some flowers belong to large trees like this one. Others belong to bushes.

6. Some plants have both male and female flowers. The next lesson will help you to recognise these.

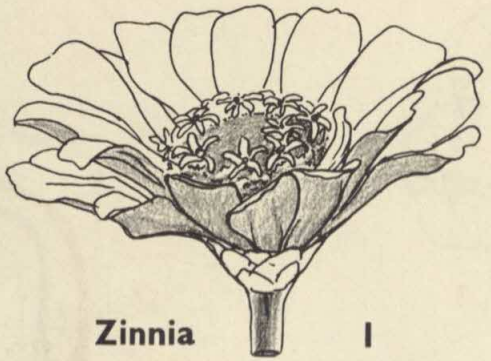
7. Some like the Moon Flower have the petals completely joined together.

8. Others like this have separate petals.

9. Grasses have very small flowers which are often not brightly coloured.

Try to collect as many different arrangements of flowers as possible. Be sure to put down in your Nature Diary where they were found and what kind of plant, bush, tree, herb, they were growing on.

Make a separate collection of grasses and press them.



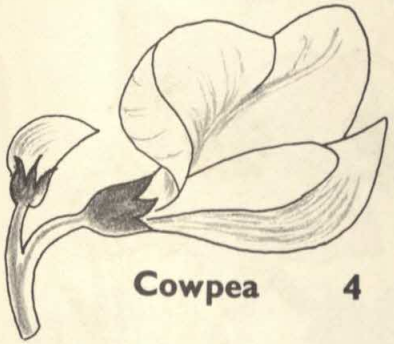
Zinnia **1**

2

Wild Arrowroot

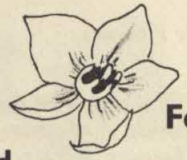
3

Cockscomb



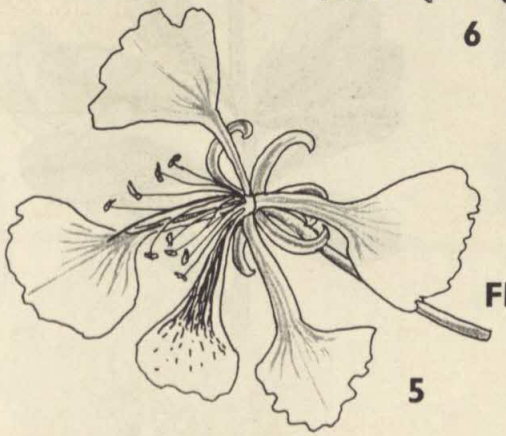
Cowpea 4

Male



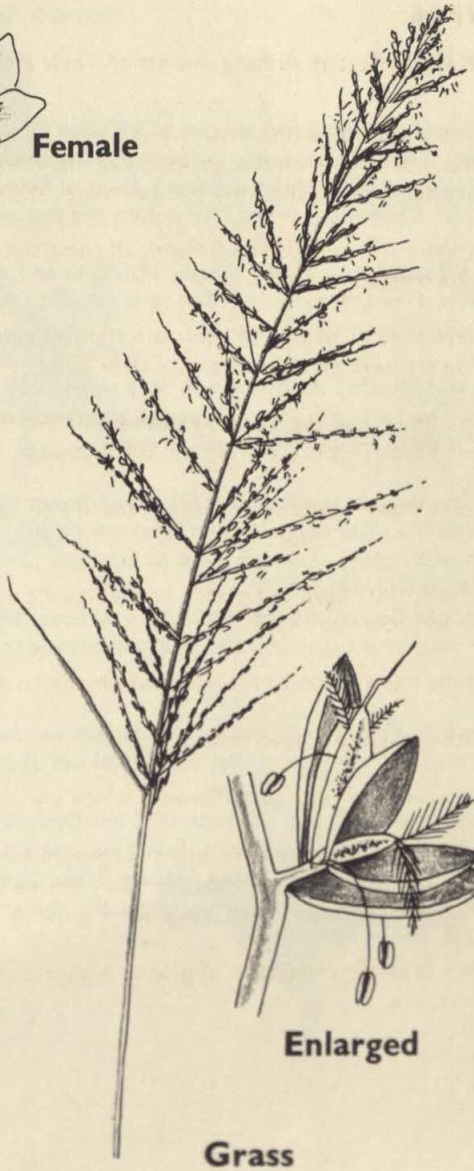
Female

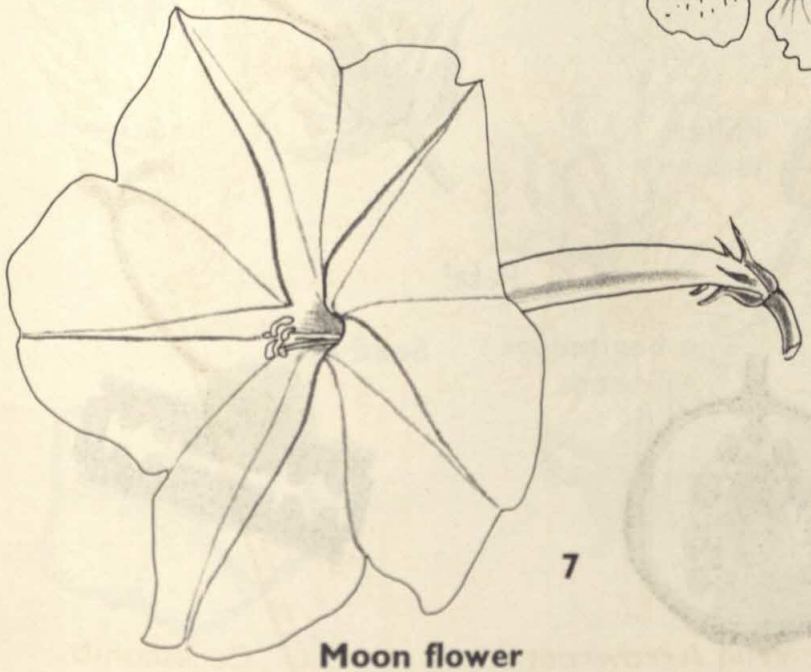
6 Gourd



Flamboyant

5





7

Moon flower

8

Goatweed

Enlarged 9

Grass

FLOWERS

Kinds of Flowers

This series of lessons can only be taken when there are a good number of flowers out. Though you need not have exactly these three flowers, you should collect at least three different kinds of flowers. *Each pupil should have at least one.* Collect them the day before the lesson and keep them in water.

Pull a flower carefully to pieces. Hair-pins and needles are useful for the small parts. Find the parts labelled in these pictures. The class should leave at least one of every kind whole.

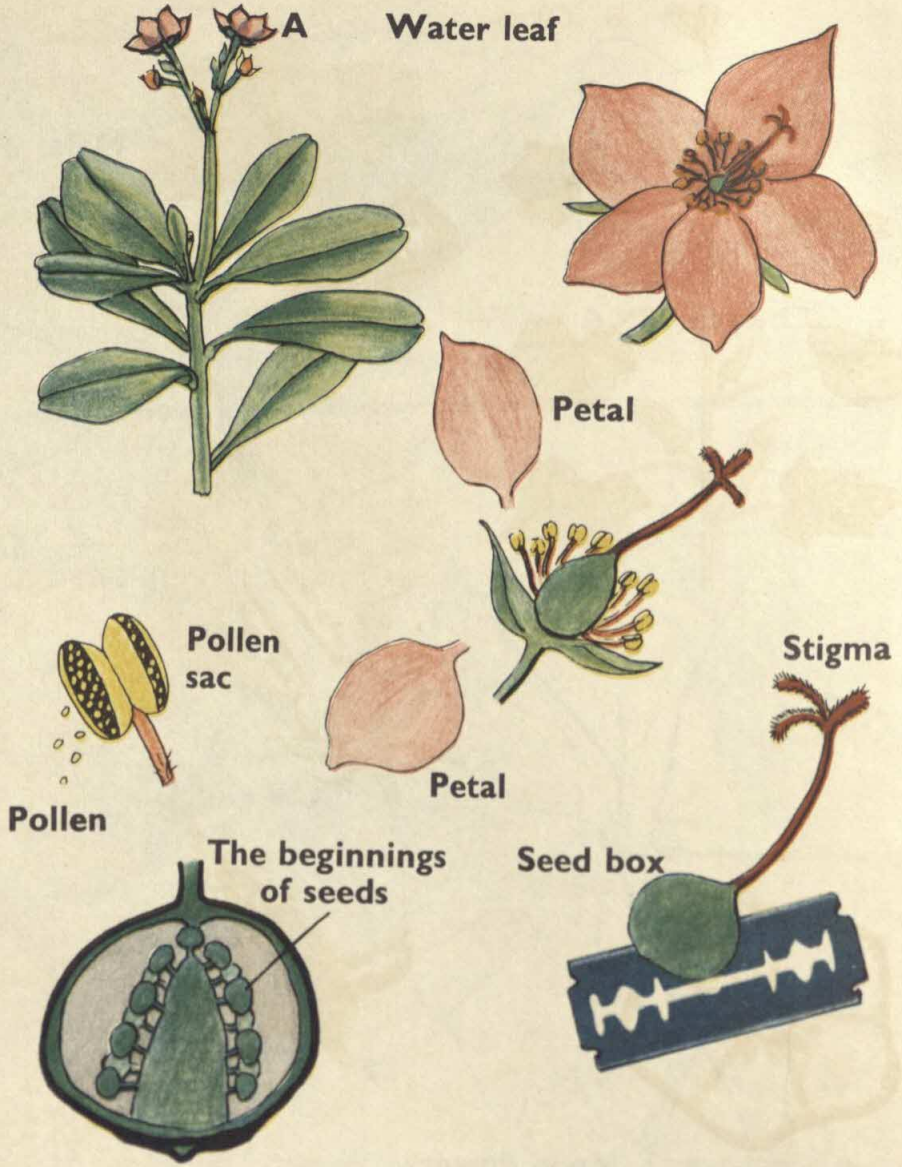
You will see that most flowers have all the different parts shown in the pictures. The parts are often arranged differently from one another and the number is different in different flowers.

In a few flowers the female parts (seed boxes and stigma) are on one flower and the male parts (pollen sacs) are on another flower on the same plant. In other cases they are even on separate plants.

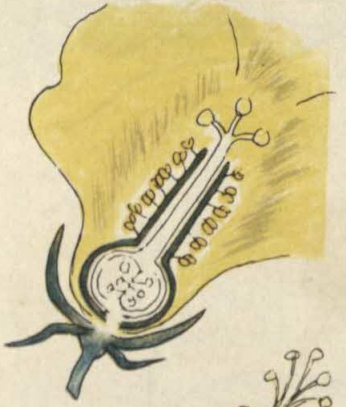
Draw one flower of each kind that you have just looked at. Draw all the kinds of seed boxes (cut in half) that you have seen. Label all your drawings well.

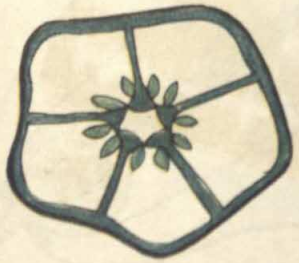
In your Nature Diary note when and where you found the flowers you brought to the lesson. Say what you found out about them.

People who study plants (botanists) put flowers into different families according to these arrangements. See if you can set out the flowers the class has left whole in Families on the Nature Table. Use the arrangement of the parts and their number to do this, especially the arrangements of petals, pollen sacs, and seed boxes.

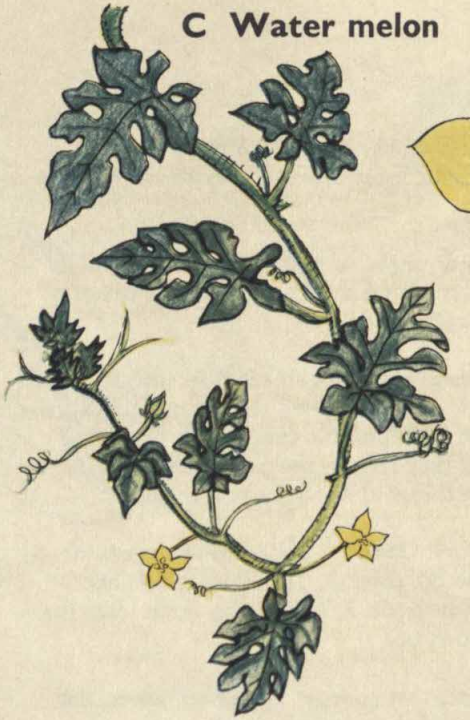


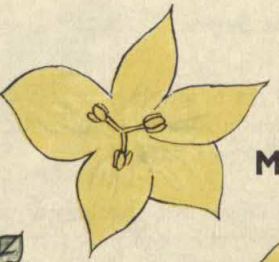
B Okra



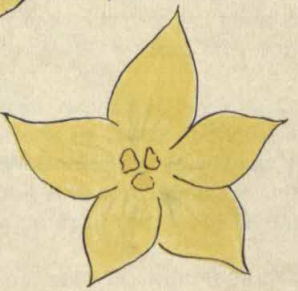


C Water melon

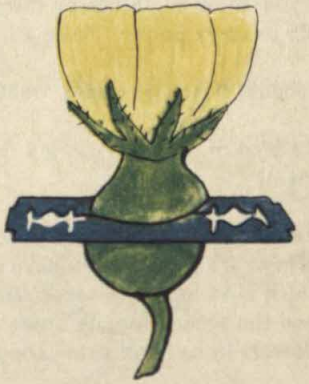




Male flower



Female flower



FLOWERS

How a New Plant Begins

To give life to the beginnings of the young seed, which is part of the flower, some pollen (a sort of yellow dust made of very, very small grains) has to enter and become part of it.

The parts of a flower are specially arranged so that this can happen. The pollen could come to the seed part from the same flower, but it is better if it comes from another flower of the same kind.

1, 2, 3, 4 and 5. Follow these pictures and you will see how insects take pollen from one flower to another and how the pollen they bring 'accidentally' enters the stigma and goes down into each 'possible seed'. They are only 'possible seeds' because it is not until they receive the pollen that they become 'alive'. If they have no pollen they will never be real seeds.

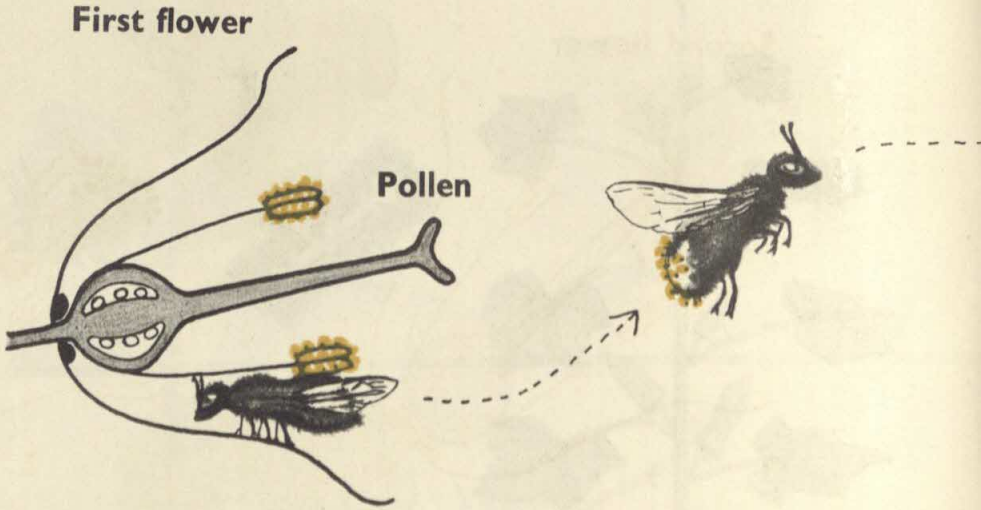
6, 7 and 8 show the rest of the story. Once the pollen has entered, the seeds can grow and get ready to leave the plant. 6. The flowers fade and then grow into the fruit with the seeds inside. 7. At last the seeds leave the plant and 8, 9 and 10, a new plant grows up.

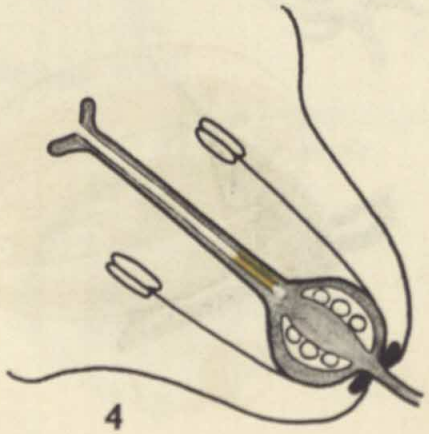
See if you know any birds or insects that go from flower to flower, and might help to carry pollen. Make a list of them in your book.

Why should a bird or insect want to visit a flower? Write your answer.

Draw a bird or insect visiting a flower. (Note the cut-away drawings on this page).

In C of the lesson before you saw that some plants have two kinds of flowers. There are some which have only pollen and no 'possible seeds', and others which have 'possible seeds' and no pollen. The first are male flowers and the second female flowers. Find some of them like the Paw Paw, cut the flowers in half and draw the two kinds. Label the parts.

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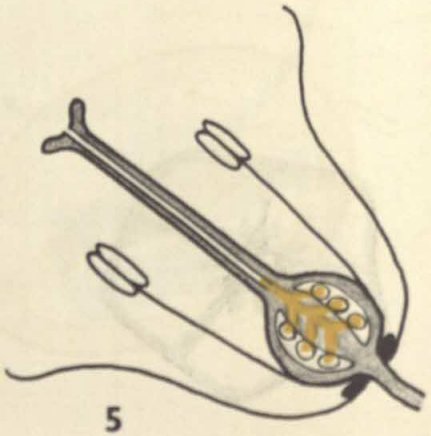
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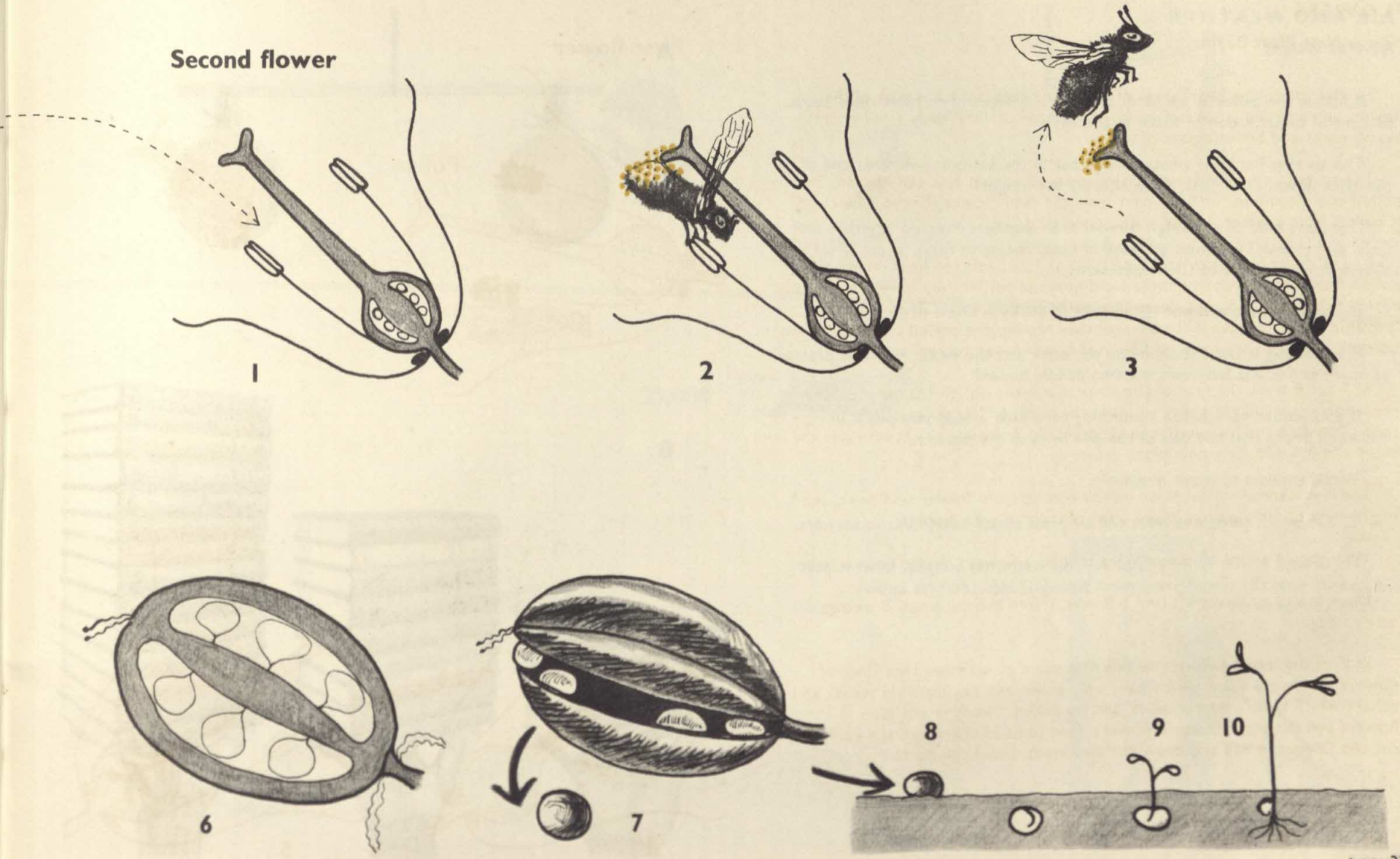

Second flower
1
2
3
6
7
8
9
10

AIR AND WEATHER

Air Has Weight

A. Blow the balloons up hard. See there is no wind to blow them about. Be careful to prick one of them at the neck.

The air that has been pressed together in the balloon pulls that end of the stick down. Does that mean that air has weight?

Does one kind of air weigh heavier than another? Pressed together air? Cold air? Hot air? (Remind yourself of experiments in Book 2, pp. 10–13.) Write down answers to these questions.

B. Your teacher will put three piles of books in front of you all.

If something is put between the top book and the next, will it be pressed as much as if it was between the two middle books?

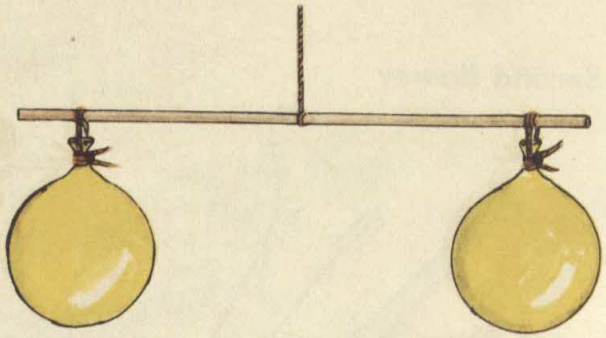
If you wanted to squeeze something very hard would you put it in between books near the top of the pile or near the bottom?

Write answers to these questions.

C. On which aeroplane does the air press most? Least? Write answers.

D. Groups of you can try this. Air like water has weight. In what part of the tin does the water press most strongly? How do you know? Write your answers.

A



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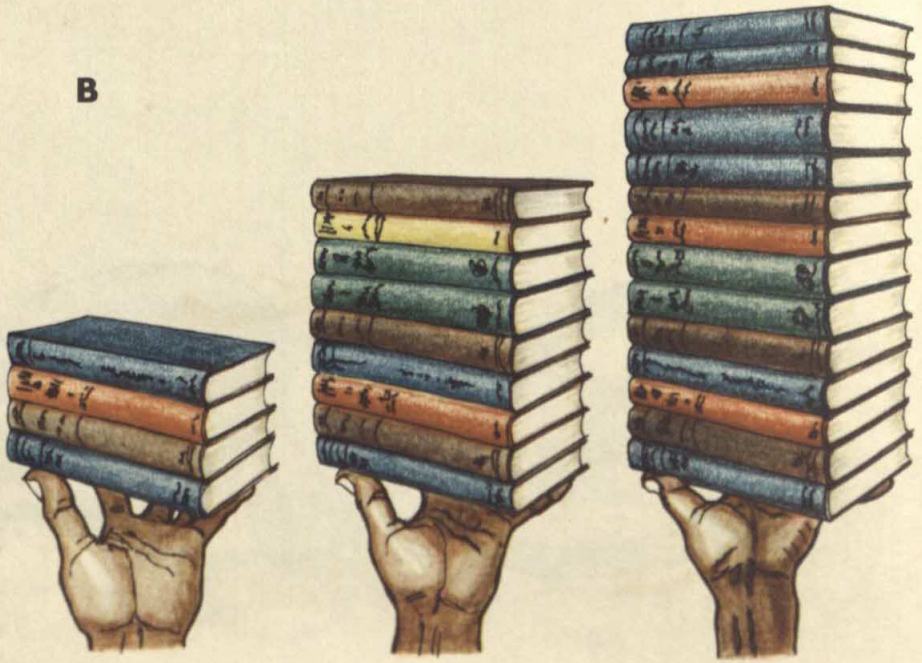
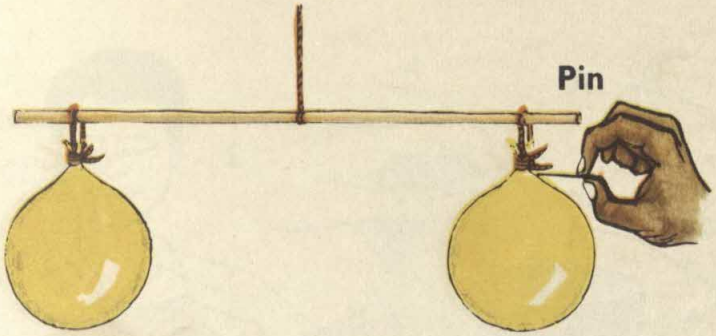
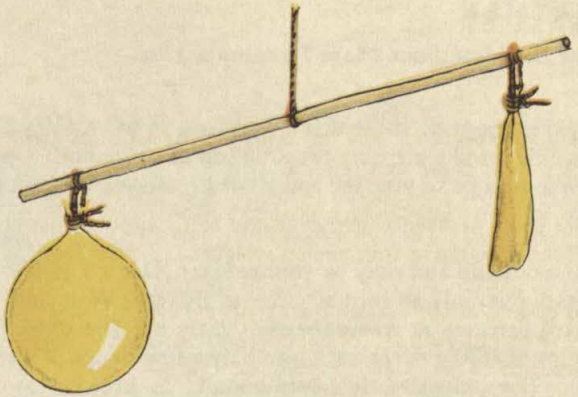
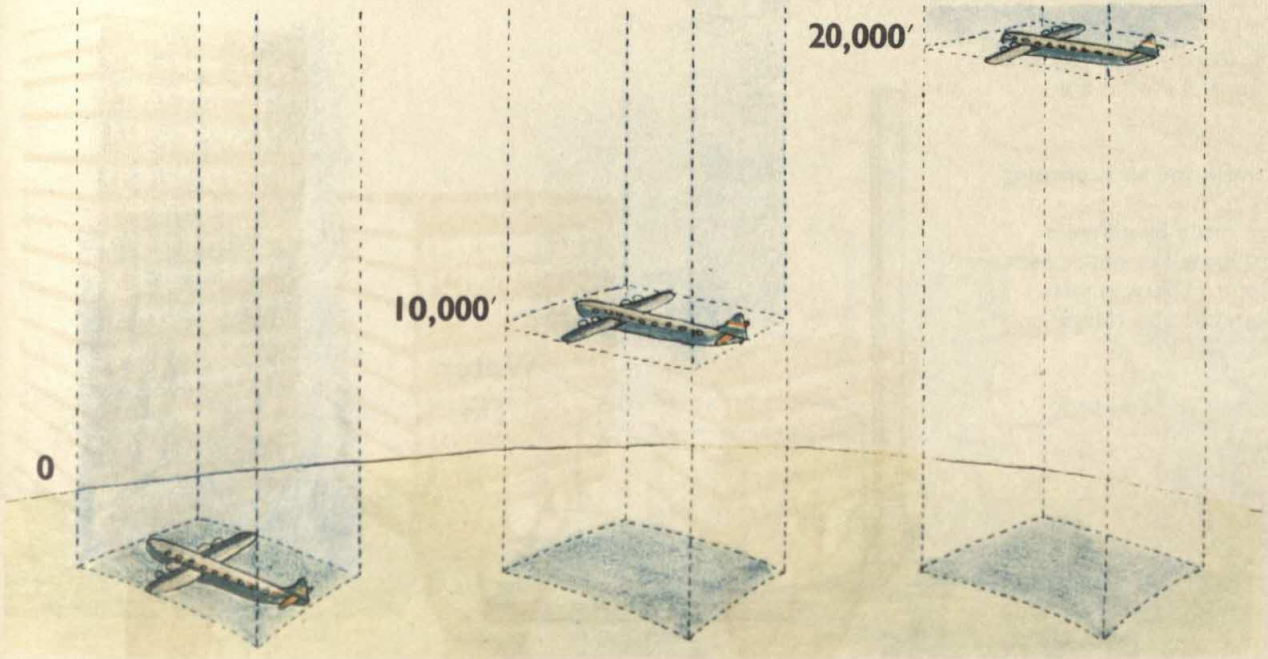


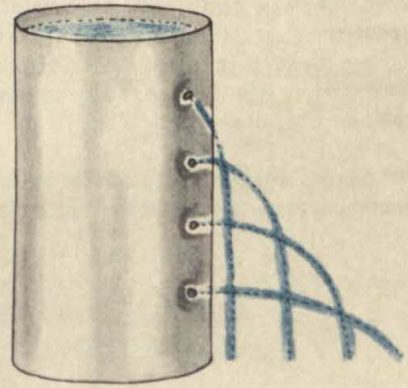




C



D



AIR AND WEATHER

The Air Presses on Us Sometimes More Sometimes Less

A is another experiment to show that air presses on us. 4. Why doesn't the water come out? Does the air only press on top of us or does it press all round us? Draw a picture of yourself and show by arrows where the air is pressing on you.

B must be done outside and only by your teacher. Use a 1 gallon oil can with a screw cap. Put only an inch of water in the can. Wait until the water is boiling hard before you screw the cap tightly on. The steam drives the air out. But a lot of steam turns back into only a few drops of water when it cools again. The air is already driven out and so, because the cap is screwed tightly down, no air can get back and there is nothing except a very little water in the can. All the air is on the outside of it.

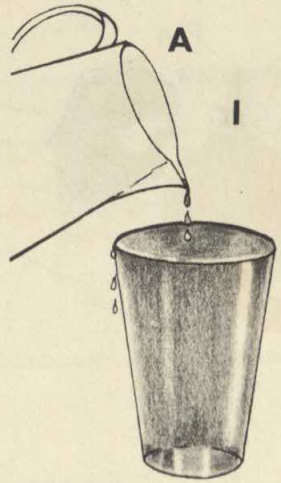
What happens? Why? Write your answers.

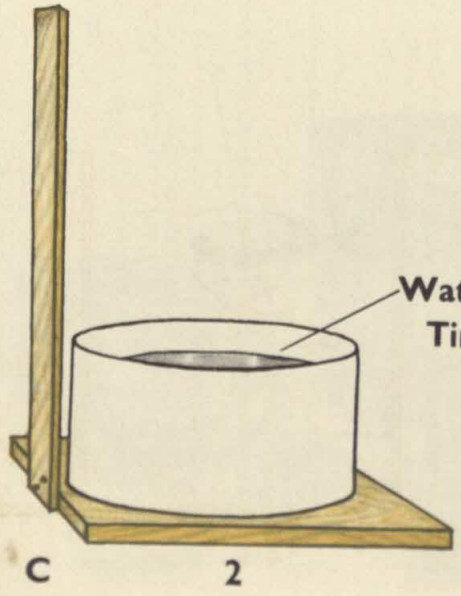
The air presses on us more some days than others. Usually it presses most when the weather is fine, and when it presses least rain and storms are likely to come.

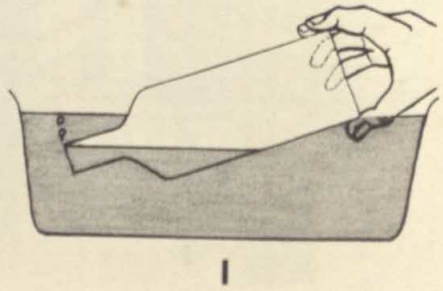
We use things called *Barometers*, to measure how much the air is pressing.

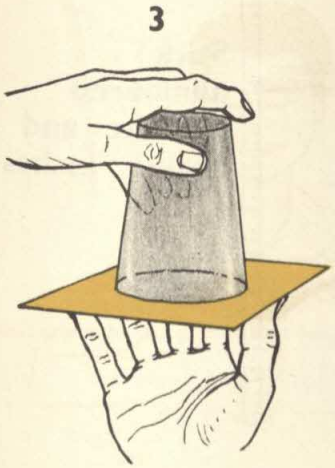
C and D show two simple barometers that can be made by different groups in the class. Number the lines on the scale you draw and notice each day where the level is. Make a note of this in your Nature Diary, as well as when it rains. See if there is any connection between the two things rain and air pressure.

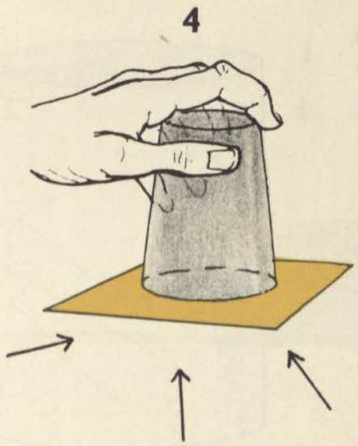
Your teacher may be able to borrow a real barometer, then you can check yours and put the proper figures on the scale.

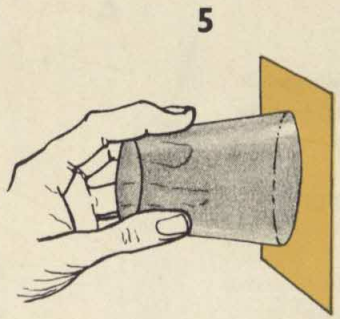


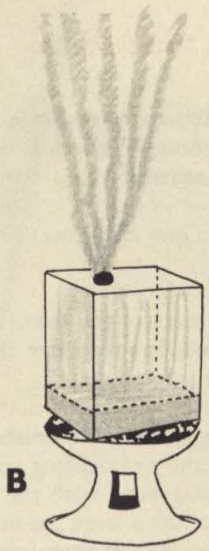


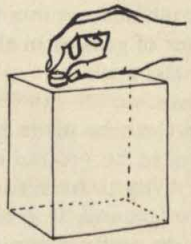


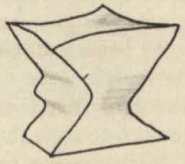


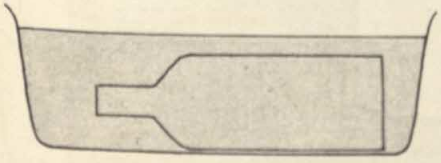


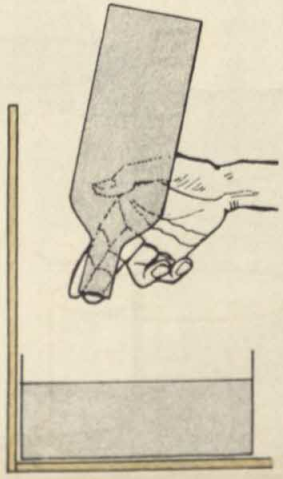


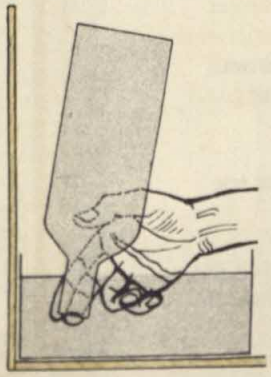


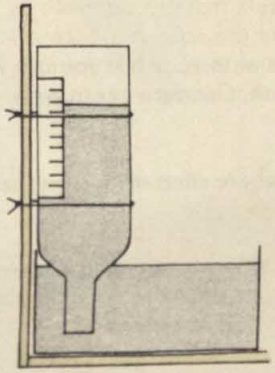


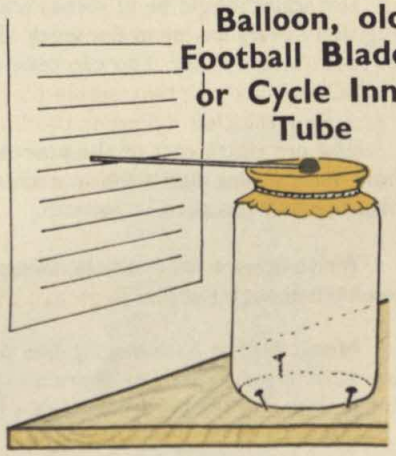












D Simple barometer

AIR AND WEATHER

Measuring How Much Rain

One of the things we always want to know about a place is how much rain falls there and when does most of it come. To do this you need to have something to measure the amount of rain that falls.

A and B show how to make two simple rain measurers or 'rain gauges' as they are called.

A. This can be made and set in a level piece of ground clear of all buildings by a number of groups in the class. The top edge should be about an inch above the ground.

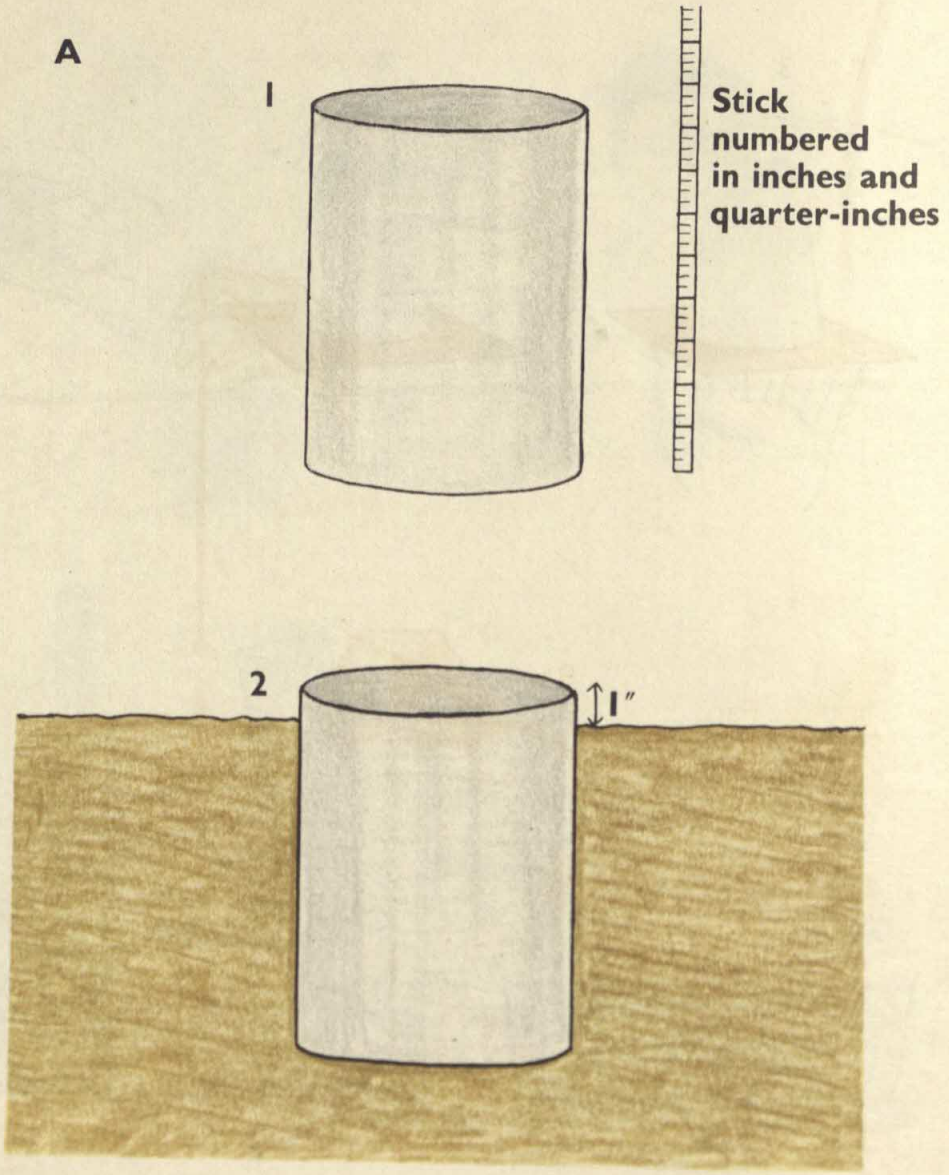
B. Several of these can be made by the teacher and finished off by you. The rough edges have to be ground away and a measuring rod made for it. Then like the other it has to be set in level ground with the top of the funnel one inch above ground. It is best to sink a large tin first for it to stand in. In this way it can be easily removed and the water accurately measured and it can be easily emptied.

The scales should be in inches and quarters. You should read the scale regularly every day or every week. Empty the gauge each time. Keep records in your Nature Diary. You can take it in turns to look after your group's gauge.

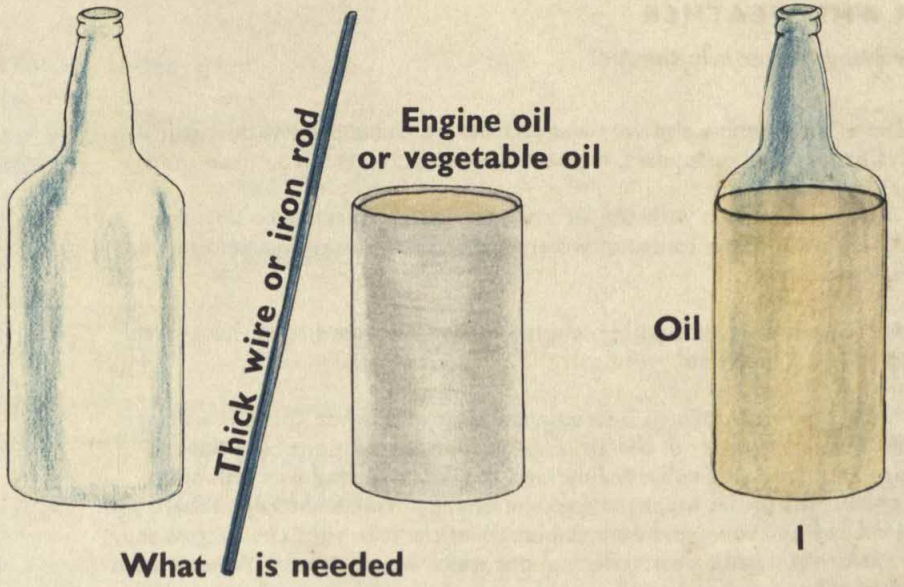
Find out which part of the year is the wettest. See if you can find out how many inches of rain fall in each month. Compare these with your measurements as soon as you can.

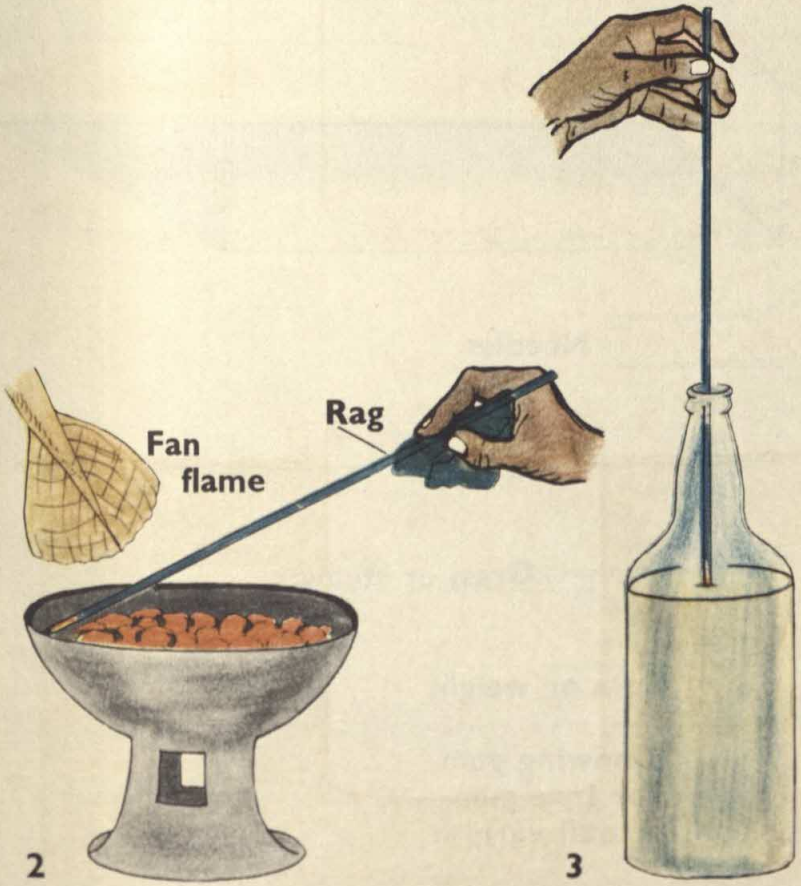
Write down a list of all the things that are affected by whether or not we have enough rain.

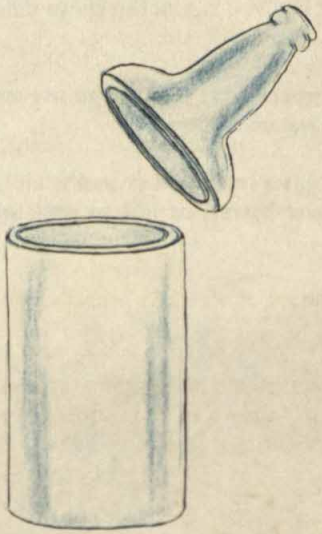
Note. *Method B for making jars from bottles can be used wherever jam jars are hard to get.* Wherever there are jam jars shown in these books they can be replaced by the bottom half of a bottle cut in this way.



B


Engine oil
or vegetable oil
Thick wire or iron rod
What is needed
Oil
1


Fan
flame
Rag
2
3


4


Measuring
rod
5

AIR AND WEATHER

How Much Water is in the Air?

There is something else we need to measure. When the water left in a tin lid or in a pool disappears, it goes into the air (Book 2).

We breathe this in with the air and it makes a difference to how we feel. Also when there is a lot of water in the air it is more likely to rain or for a mist to come.

Hairs from your head will go shorter or longer according to how much water there is in the air.

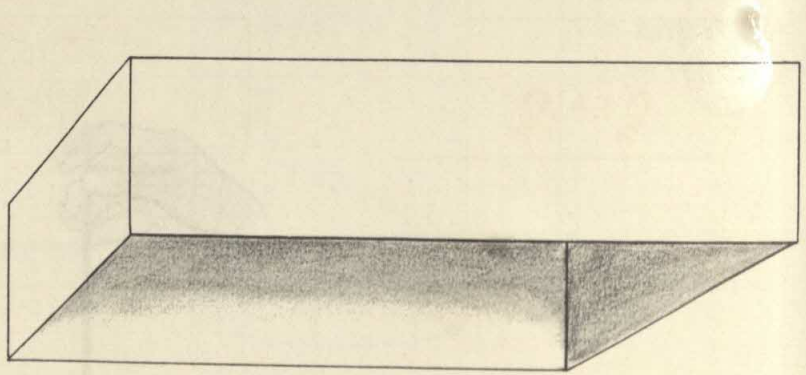
Here is how to make an instrument for showing when there is a change in the amount of water in the air. Each group can make one. Any kind of strong cardboard box will do. Any kind of gum or sealing wax will do to fasten the hair to the weight and to the needle at the other end. Where you will cut the box will depend on the length of the hair—get the longest you can. Before you mark your scale find out which way it moves. When it rains hard on a hot day you can call that the top of the scale and mark it as '10', make the other nine marks afterwards. Now you can enter these differences each day in your Nature Diary.

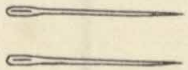
What other things go short when they are wet? Could you use any of them to show changes in the amount of water in the air?

What other signs are there that there is a lot of water in the air? Seeing and hearing is affected. Can you see or hear better, or not so well, when there is a lot of water in the air?

Write your answers to these questions.

What is needed





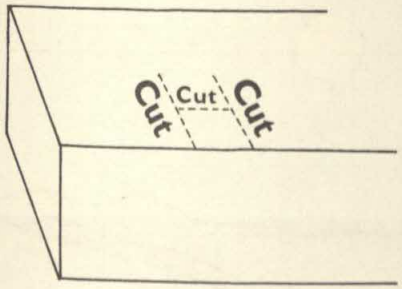
Needles

Hair

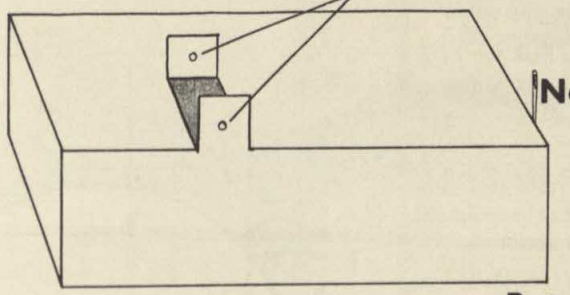
Grass or straw

Coin or weight

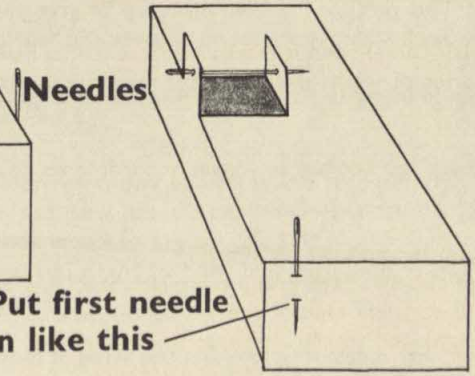
Chewing gum
or tree gum
or nail varnish


Cut
Cut
Cut

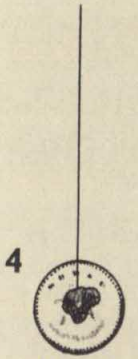
1

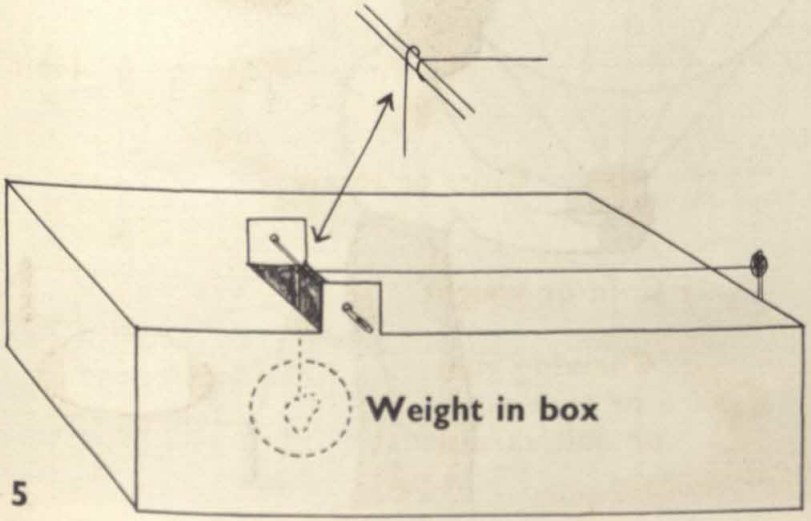

Holes made large
enough
for easy movement

2

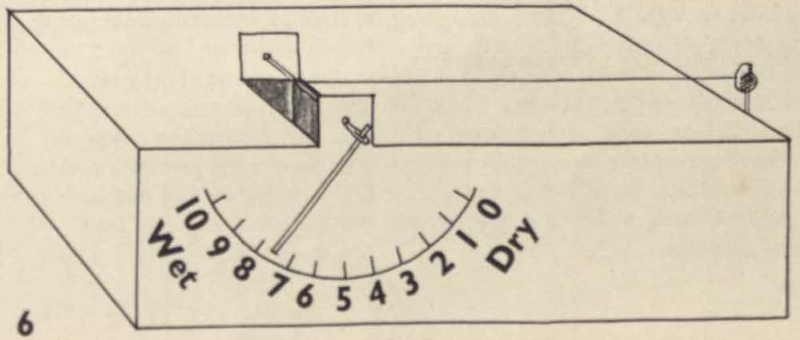

Needles
Put first needle
in like this

3


4
Small coin
fastened with
gum or used
chewing gum
or nail varnish


Weight in box

5


Wet
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AIR AND WEATHER

Weather Stations

Here is a picture of some of the instruments you have learnt about as well as one or two more. This picture has been made up to give you some idea of a weather station. Such stations are found all over the world.

1. Here a large balloon is being launched with weather instruments attached.

These go right up into the highest clouds (9). Do you remember the name of these very high clouds? At last they burst and the can with the instruments in it comes down by parachute (6). In this way we get to know about the amount of moisture and the temperature and wind strength in the upper part of the earth's air.

3. This is an instrument for measuring how fast the wind is blowing. It is called an anemometer.

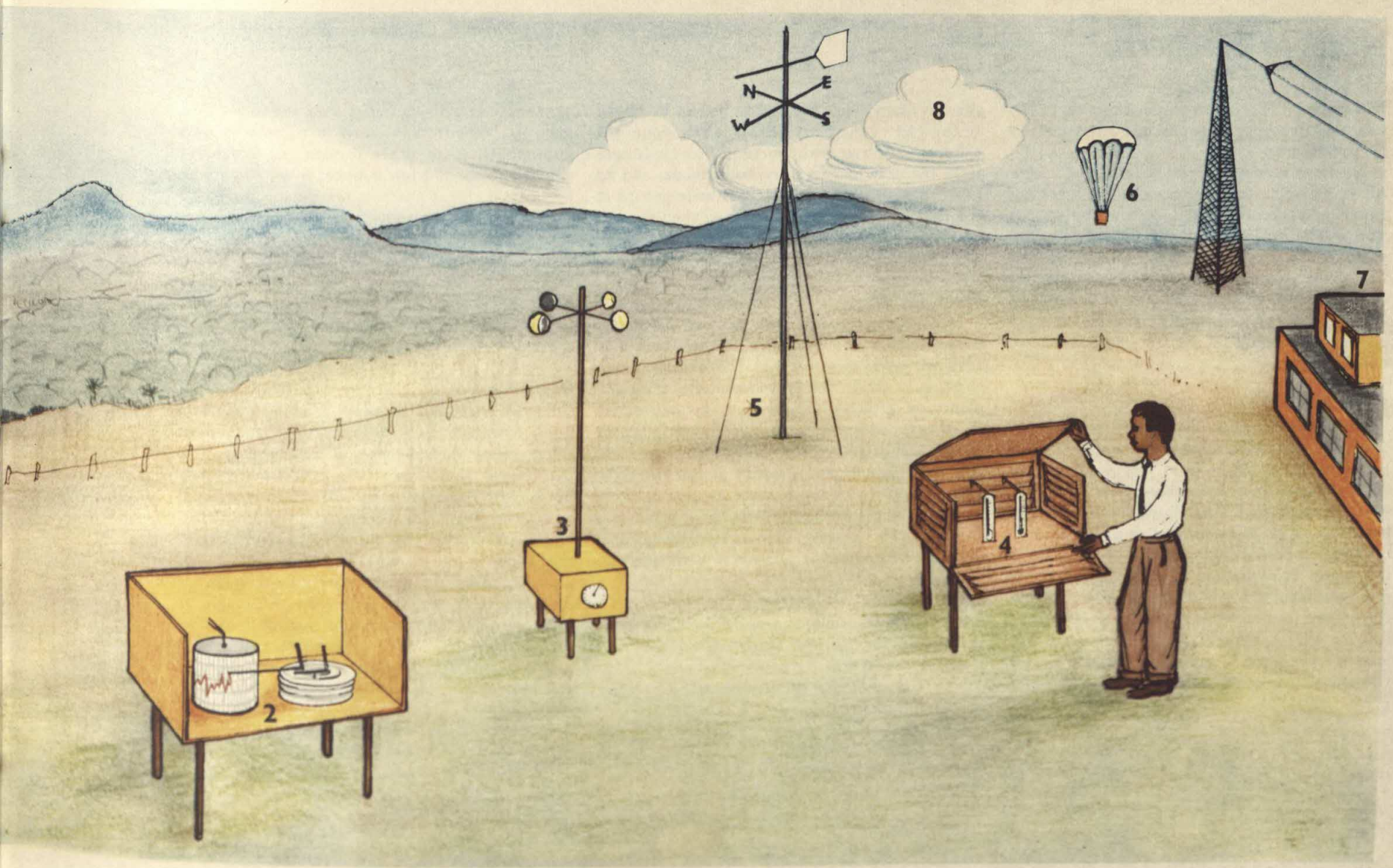
7 is a radio station. These play an important part in telling one part of the world what sort of weather is on the way from another where the station is.

What are 4, 5 and 10? Write down what they are used for.

From which direction is the wind blowing?

What sort of clouds do you think are shown at (8)?

Do you know what 2 is? The round thing on the left is a drum with paper on it and as the air presses more and less on the sealed tin on the right, so the long arm makes a mark as the paper travels slowly round. This goes round in one day, so that each day if you take the paper off you can see how the air pressure has gone up and down during the day. Nowadays nearly all the weather instruments in weather stations have some arrangement to keep a record themselves. Some instruments are not shown here—like one for measuring how much water is in the air, and another for measuring the amount of sunshine.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Notes to Teachers

This is a pupil's book, but the work demands considerable forethought, preparation and guidance by the teacher.

You do not need any special knowledge of science. All you have to do is to try out the work and experiments yourself well before the lessons. You will enjoy doing this and your own understanding of what you are teaching will be helped. This done, you may look forward to leading the children easily through each step of understanding. You will be surprised at the pleasure and confidence you will get from trying these things out in private.

Syllabus

The books are not divided rigidly into 'lessons'. One page may well occupy two or three teaching periods. That is left to you. The work *is*, however, grouped. Two or three pages at a time deal with the same topic. You should finish each topic before going on to something new. But there is no need to do the topics in the order given in this book. You may find it more convenient to deal with them in a very different order, depending on the season of the year and what you are able to get as material for your lessons. For instance, the group of topics in this book headed 'Weather' should be worked through BEFORE the last term although this has had to be placed at the end of the book. If this is not done, the children will have no opportunity to read regularly the instruments they have made, and to keep records. Plan the order of your groups at the beginning of the term, or even the year, but be prepared to change this at any time if there is a good reason for it.

Practical Work

Try every experiment first yourself before the lesson. Look at the work two or three weeks in advance, because sometimes the children have to bring or collect things, and sometimes experiments in growing things must be started as much as three weeks ahead. The biggest problem at first will be getting the children to bring what you want in sufficient quantity and at the right time. It will pay to concentrate on getting them to do this in the early stages. As for yourself, you will find that whatever demands practical preparation beforehand is printed in *light lettering*.

Written Work

If possible the children should have one exercise book for Nature Study, Gardening and Hygiene together.

It is important that children should keep their own records of living things they see (Book One, page 4). When other work is completed by a pupil in these or other lessons, he should be allowed to spend a few minutes in writing up his records. If this is not possible during the day, a short time during some Nature Study periods should be specially allotted to it.

Sometimes this book asks children to supply written answers to questions. *After* they have done this, you must go over the answers with the whole class, and also see that each pupil corrects any mistakes he has made.

Drawings

Even a crude and unskilled drawing made by a pupil from his own observation is a hundred times more valuable than a careful copy of a blackboard sketch or a diagram from a textbook. With your help, he will improve in time, but *never* allow him to copy.

You will realise that this course tries to train the child in observation and give him a *real* understanding of the subject largely through his own practical and written work. Although, as in all subjects, correcting and testing must play a part, your task will mainly be to ensure that proper preparations have been made, to organise and to give guidance and encouragement.

Helpful Books for both Teachers and Pupils

From *African Welfare Series* Oxford University Press
WATER AND LAND Clements and Topham
THE AFRICAN AND HIS LIVE STOCK Thornton and Leckie

From *Science at Work Series* Oxford University Press
INSECTS AND DISEASE Edney
WEATHER Ellis

From *Simple Science in Simple English* Oxford University Press
ANTS AND THEIR WAYS McKay
BEASTS AND BIRDS OF AFRICA Longden
SOME TROPICAL PLANTS AND THEIR USES Irvine

A FIRST TROPICAL NATURE STUDY Deakin, Longmans
ANIMALS OF WEST AFRICA Cansdale, Longmans
THE OUTDOOR WORLD (Series of six) Skaife, Longmans
A HANDBOOK OF AFRICAN FLOWERS Saunders, Oxford University Press

For Teachers
THE TEACHING OF SCIENCE IN TROPICAL PRIMARY SCHOOLS E. D. Joseph, Oxford University Press
ELEMENTARY BOTANY FOR WEST AFRICA E. M. P. Walters, Allen & Unwin

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